SCIENTIFIC AMERICAN

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Despaquis' Photo-Engraving Process.

M. Despaquis has observed, like all who have occupied themselves with this branch of study, that in an engraving it is necessary to have a grain inside the cavities, while the surface should be of a polished character in those portions destined to reproduce the whites of the image. He therefore set about to discover how such a result could be brought about. He applied to the metallic plate two films of gelatin, the first a thick one containing the grain, and the second thinner and absolutely free from grain. It is due to this second film that M. Despaquis is enabled to produce all the delicacy of half tone. His method of operation is as follows: In one thousand cubic centimetres of water are dissolved two hundred grammes of gelatin; to this are added twenty grammes of liquid Indian ink and four grammes of powdered pumice, the latter being finely ground and sifted through fine linen. Next, upon a plate of glass which has been waxed, he spreads a sheet of moistened paper, taking care to prevent the formation of air bubbles. The solution of gelatin, previously filtered and maintained at a slightly warmed temperature sufficient to keep it liquid, is then poured upon this sheet of paper. In this way a sheet is secured, covered with a thick film of gelatin having a very fine grain, uniformly spread throughout its body. When it is desired to make use of this prepared paper the second film is applied, and the sheet sensitized at the same time; to do this, it is immersed (prepared side uppermost) in a solution composed of:

Water.....	500 cub. cents.
Gelatin.....	1 to 15 grammes.
Bichromate of ammonia.....	15 "

After remaining in this liquid for some seconds the sheet is taken out, and by two of its corners (still prepared side uppermost) it is drawn over a gelatined plate, previously prepared with ox-gall, so that later the paper may be easily detached. The sheet, dried in a locality where it is screened from daylight, is cut a little larger than the cliché, and placed underneath the latter. The exposure of the prepared sheet to the light should be a third that necessary to give a carbon print. As in this latter process, as soon as the printing is finished, the impression is plunged into cold water, so as to transport the print, not to albumenized paper, but a plate of polished steel or copper; it is afterward put under pressure, and allowed to dry, and finally the image developed, as in the carbon process, with warm water. It is, indeed, treated as if it were a carbon print, rather more care being taken, however, because there is less adhesion between the gelatin and the polished steel. When the matrix plate has been secured in this way, a mould is made, either in the hydraulic press, as in the Woodburytype process, or in a rolling mill, covering the plate with a double sheet of very stout lead. The mill must be worked two or three times, so that every detail of the image is reproduced in the lead. Finally, you produce by the aid of the electrotype process a countermould, which is the plate from which the printed copies are produced.

An Illuminating Cannon Shot.

One of the most simple and ingenious contrivances, for the purpose of investing a fleet with a zone of light through which no enemy could pass without being observed, has been devised by M. Ferdinand Silas, of Vienna, whose experiments with lifebuoys at Portsmouth have been reported in these columns. M. Silas' inextinguishable lightning shell is similar to a common shell, can be made to fit any gun, and can, accordingly, be projected to any distance. The projectile consists of three parts, one within the other. Within the shell proper is a lining of wet sponge, and within this is a glass bottle, which fills the whole cavity; the bottom of the shell unscrewing to admit of its entrance. This bottle is filled with various charges of phosphide, none of which, however, is to be less than ten pounds. A small channel is bored through the sharp point of the shell in order to allow the air to mix freely with the wet sponge, and there are a couple of apertures in the head which are plugged with wooden stoppers covered with leather. Through the movable bottom of the shell a steel striker is inserted, which is fitted with a spring, and communicates with the glass bottle within. When the light shell is fired, the spring striker is driven forward by the explosion like a gas check and so breaks the bottle; the water contained in the jacket of sponge then penetrates through the broken glass and saturates the phosphide; phosphuretted hydrogen is immediately generated in large quantities, by the pressure of which the stoppers are forced out and two streams of illuminating matter are poured upon the sea. The light burns with great brilliancy for a considerable time, and is claimed to be inextinguishable.—*London Times.*

CABLE FASTENINGS OF THE EAST RIVER BRIDGE.

In an article last week we followed the progress of making one of the strands that is to form the massive cables designed to support the roadway of the East River Bridge. These strands are a little over three inches in diameter, and the diameter of the cable when completed will be about fifteen and a half inches. We have seen the strand in place and resting in its permanent seat, the saddle, on top of the tower. We will now detail the manner in which the ends of these strands are secured and held in place at the anchorage at each end of the bridge. In the engraving, Fig. 1, which is taken from the Brooklyn anchorage, is shown the manner in which the wires are wrapped around the iron shoe as they are received at the anchorage. In the front of the engraving will be observed a massive iron bar, to one end of which this shoe, similar in form to a horseshoe magnet with armature in place, is attached. In folding the wires around it, as received from the carriers, the shoe lays horizontally, and the bight

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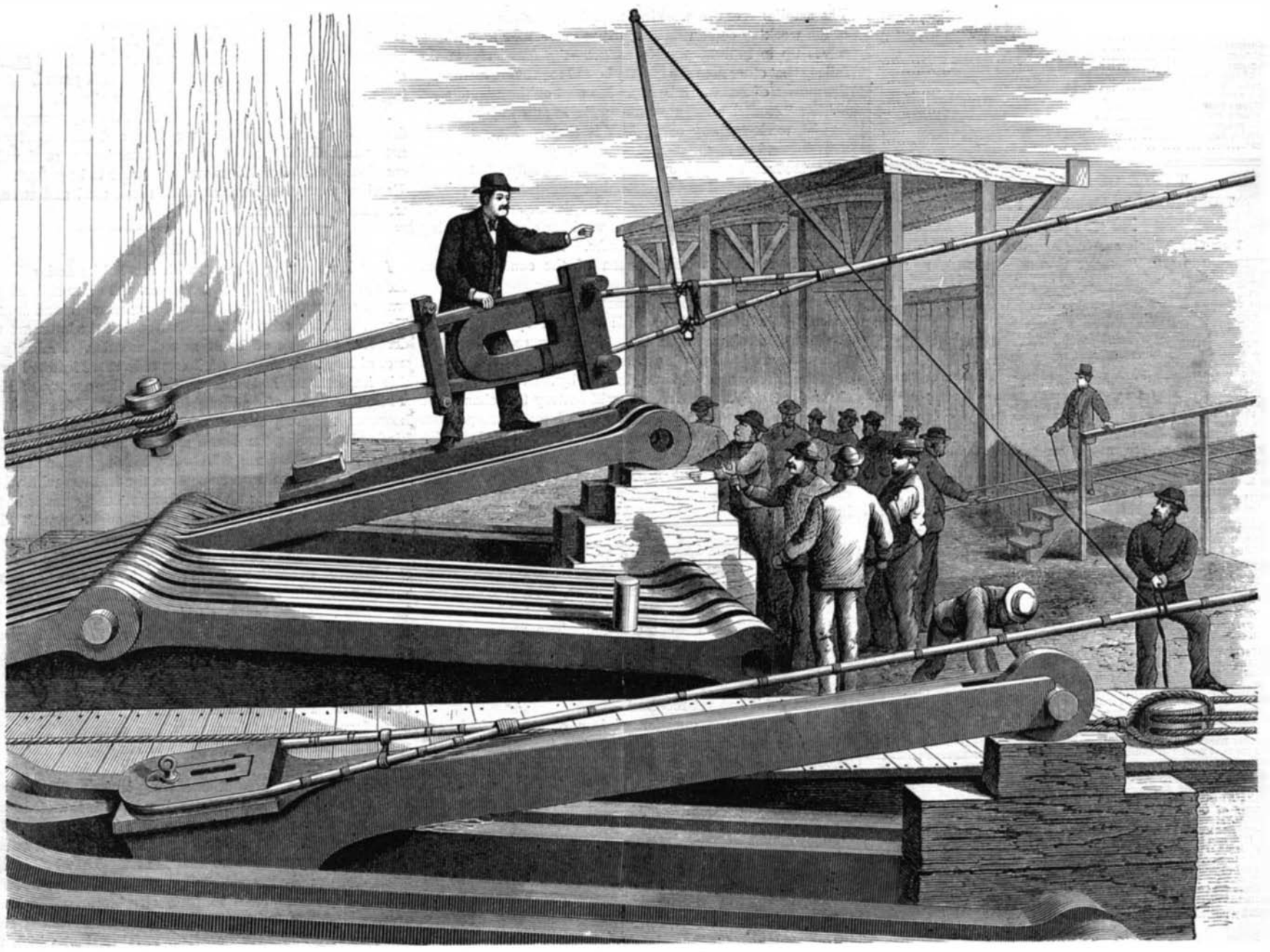

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.—THE CABLE FASTENINGS.

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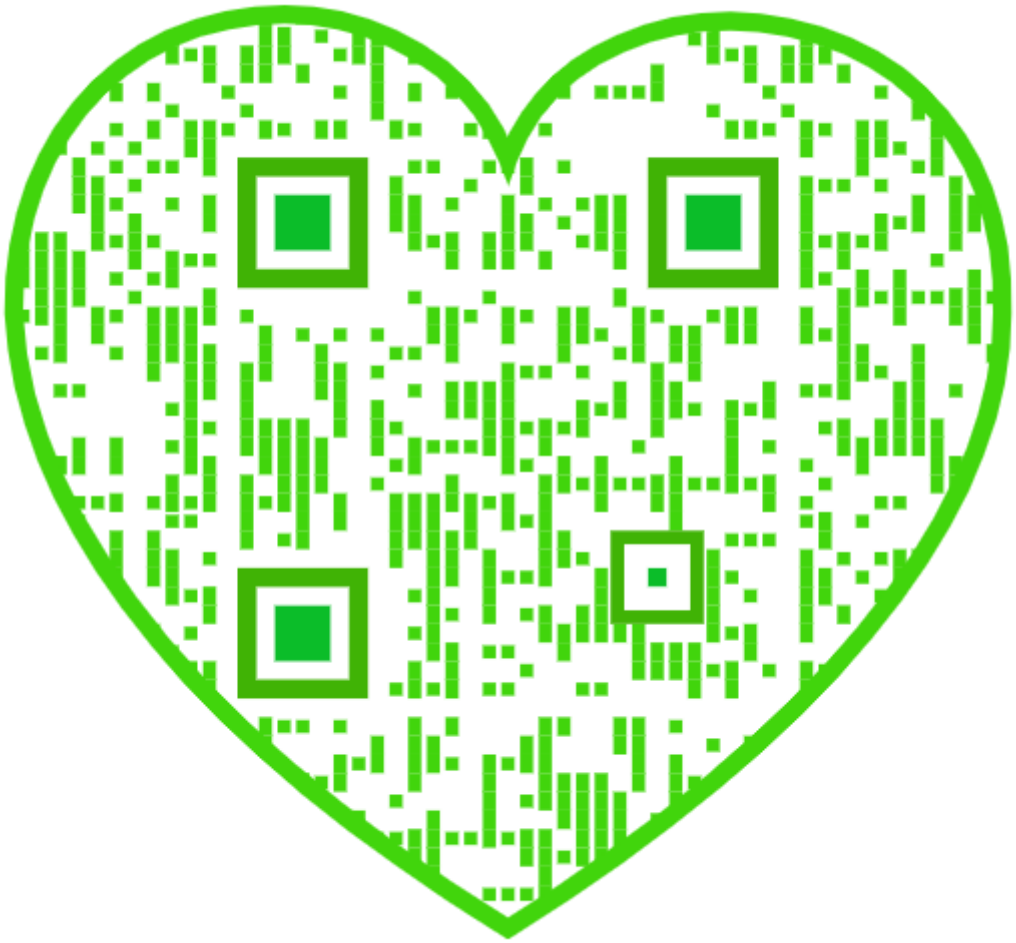

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NEW YORK, SATURDAY, AUGUST 11, 1877.

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THE DEGRADATION OF LABOR.

Labor is honorable, and the laborer worthy of honor in direct proportion to the personal integrity, independence and capacity that go with it. Abject servitude, even when voluntary, is neither honorable to the individual nor profitable to the mass.

This is the American idea: it is the independent laborer that honors labor. Unhappily of late years the majority of our working men have forgotten or failed to learn this basic principle of our social, industrial, and political system. Worse: they have hearkened to demagogues who have taught them contrary doctrines—doctrines subversive of all true manliness in working men, and calculated only to degrade labor by reducing the laborer to practical slavery.

Could there be a bitterer satire on the manliness of working men than the mainplank in the platform of the "bread winner's league"—bread beggar's league, more properly—to the effect that the government—in other words their fellow citizens—should furnish them with employment and wages? Is government servitude the highest aim of the present generation of working men?

Time was when the American laboring man's boast was that he was, or was bound to be, his own master, asking odds of no one. He felt himself a free man, capable of self-support; a man whose strength and skill need not go a-begging for employment. While this was the rule labor could not be redundant. The laborer was not abjectly dependent on some one to hire him, for he was able and willing to to work for himself. However limited the scope of his productive industry, he was, or could be an independent producer; and his work was to be sought for if it was to be hired.

But all this, it would seem, has been changed. As a rule the laborer—tradesman, mechanic, artizan, or what not—is not and no longer aims to be first of all a free man. On the contrary he desires nothing and looks forward to nothing but to be dependent on some one for a job. He must be hired, or he can do nothing; and such employment failing he falls back, not on his own capacity for self support, not upon independent industry, but to the vain demand that government shall make work for him. Then having made himself utterly dependent on wages, he foolishly imagines that he can overturn the fundamental laws of work and wages, and dictate the terms at which he will be employed and the kind of work he will do.

The first lesson that the working men of the country need to learn is that they have no claim upon any one—individual, corporation, or government—for employment. They are not infants, but men: and they must be willing to act a man's part in the great industrial struggle, or go to the wall. Inability to find a master is no excuse for idleness; nor more is any lack of demand for the specific labor they prefer to do. The manliness of the working man is gone, the prosperity of the working class vanishes, the moment men give themselves up to individual helplessness—the first fruit of the fallacy that other men are in duty bound to provide them with the means of making a living. No part of the community, neither "capital" nor government, is in any way bound to furnish work for any one. And it matters little whether men demand or beg that employment be given them as their only resource against starvation, they ask only what would but seal their moral and industrial degradation. To persist in huddling together in increasing helplessness, is simply to rivet the chains of the slavery the working classes are doing most to bind upon their own limbs. The laws of Nature cannot be reversed to relieve men of the consequences of their folly.

Not until the old spirit of manly self respect and individual self-helpfulness is revived: not until the majority of the industrial classes seek first to become, sooner or later, their own employers, will prosperity return to them. Until then the labor market will be glutted; by their very numbers the mob of employment seekers will destroy the chances of all for steady employment; and by their hungry competition with each other they will dissipate the only hope of any for remunerative wages. It is not any absolute redundancy of laborers as much as the misdirection of their efforts that makes or largely helps to make the times so hard for laboring men.

IRON AND STEEL IN RAILWAY CAR CONSTRUCTION.

At the annual meeting of the Master Car Builders' Association, held in New York city, June, 1876, a committee was appointed to whom was referred the subject of iron and steel in railway car construction. The report of this committee, given in the late meeting in Cleveland, Ohio, was that the substitution of steel for iron in car construction was a subject of first-class importance, and merits more attention than it had yet received.

In answer to the question of iron or steel rods in car bodies, the majority preferred iron, but it must be iron of 60,000 pounds textile strength to the square inch. Open hearth steel was admitted to be tougher and denser, but was too expensive. It was thought that steel could be produced, that with less size and weight would give equal strength. Of bolts, all preferred iron, though none seemed to have tried steel bolts. Charcoal iron was specified in the report, and the suggestion was made that good iron was better than poor steel. Of steel nails, the majority admitted to not have used them, while in one instance they were preferred because they were lighter, and as cheap as iron. Another member had received some samples with request to try them, and he reports that he had no difficulty in driving every steel nail to the head, while he found it impossible to drive a cut nail more than half way before it would break.

In order to further test the economy of steel nails, the returning board gave the following table of the weight of iron and steel nails as one of the results of their labor:

4d.	Iron nails,	260	to lb.	Steel nails, 208	to lb.
6d.	"	145	"	" 142	"
8d.	"	90	"	" 80	"
10d.	"	62	"	" 59	"
12d.	"	47	"	" 38	"
20d.	"	28	"	" 20	"
40d.	"	13	"	" 12	"
6d.	finish'g iron nails,	192	to lb.	" 188	"
8d.	"	110	"	" 92	"
10d.	"	84	"	" 70	"

The price of these nails was quoted as 50 cents per keg more than iron.

Steel screws were admitted by one or two persons to be fifty per cent stronger than iron, yet the majority preferred iron. Another recommendation of the steel screw was that there were no imperfect ones found; yet this must be admitted to be a recommendation for the manufacturer of said screws. The roughness of annealed steel screws was complained of, as well as their tendency to twist. It was admitted that where iron screw heads touched iron, they were better in that condition that steel screws.

It was thought that the carlines of passenger cars, if made of steel, would be more rigid than iron. It was suggested that body bolsters, if made of steel, would be lighter, and in the end might be as cheap as iron. It was thought that a sudden shock would be liable to break the steel bolster, yet the experiment had not been tried.

Of axles, the majority preferred steel, and open hearth steel was recommended as being more likely to be free from cracks. Some claimed that iron axles run with the coolest journals, while others advocated for steel the same advantage. It was admitted that the low price of iron axles hindered making them as good as they should be. The recommendation for the steel axle was that it could be lighter, and its stiffness prevented crystallization. Steel axles do not bend as iron, though they showed in some instances a tendency to crack in the inside of the wheel hub. Lubrication was more perfect upon steel surfaces than upon iron, and they worked with a much finer surface than iron axles, and would wear longer. One member had commenced a series of microscopic experiments to get at the cause of the iron axles heating, and found that the fibres of the iron stuck up, as he said, like knife blades.

The majority preferred cast iron wheels, though steel was thought to be safer. One fault of the steel wheel was that it would split in the tread. Brake shoes of steel showed less percentage of loss by wear than the iron, and no percentage of difference was found in the wheel to which they were applied. Upon a car that had run nearly ten thousand nine hundred miles, the wrought iron shoes weighed, when applied, thirty-four and a quarter pounds; when removed, weighed thirty one and a quarter. A pair of steel shoes weighed thirty pounds, and when removed weighed twenty-eight and a half pounds, having lost one half pound. Showing one and a half pound of loss in favor of steel.

A conservative character appeared in the reports upon the distinctive merits of steel over iron, and the majority did not seem inclined to make a change from iron to steel, unless convinced that decided advantages were to be gained. Indications seem to show that, with them, steel and strength were not synonymous.

ABOUT SPARROWS.

Any European conversant with the habits and color of the sparrow in his original home on the other side of the water, and who closely watches the sparrows in and around New York city, cannot fail to observe that the latter are undergoing a change of habit as well as color. Probably no part of England, if even of Europe, is more infested with this impertinent little fellow than is the county of Kent where the barnyards and fields abound with them. It is, however, necessary to draw a distinction, for there are two kinds of sparrows, the house sparrow and hedge sparrow. The former builds a ragged, clumsy-looking nest, notable for its size and external looseness; even the feathers with which it is lined are placed in no kind of order, but appear to be put together in a spirit of "that is good enough for me." The eggs are a dull white color, speckled with reddish brown spots, and number from four to six; rarely less than the former, and never exceeding the latter. The house sparrows rarely gather in large flocks, or indeed flock at all, save in winter. They build their nests in colonies if the conditions are favorable, otherwise they will build in nooks about cornices, under waterspouts, and sometimes in trees. Over the main entrance door to Trinity church in New York city are several house sparrow nests built in the ornamental stonework. In the ornamental cornice work of many brown stone front residences the same will be observed. The hedge sparrow is similar in appearance to his *confrère* save that he is a trifle smaller. He is much more tidy, however, in his household affairs. He builds a snug little nest, neat and compact outside, and carefully lined, with horsehair and feathers inside, made round and with a full open top. The fibers of which it is mainly composed neatly interwoven, and it is as cosy withal as a linnet's nest. They build separately and usually in small hedgerows, leaving the holes in trees and similar places to their city brethren, the house sparrows. They lay five small eggs of a beautifully clear blue color. The hedge sparrow it is against which the European farmer wages relentless warfare in the grain and seed fields; while the house sparrow is attacked in the barn-

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yard about the stacks. The hedge sparrow, in reasonable numbers, is a valuable insect-destroying aid to the farmer, and so indeed, in a lesser degree, is the house sparrow; but the swarms of hedge sparrows to be seen in the southern counties of England are sometimes as relentless and exacting as the worst case of tax gatherer. Except in nest-building season, the hedge sparrow can be distinguished in the air by his flying in compact and well defined flocks, scorning the careless, disorderly, and irregular flight of the house sparrow. When a flock takes alarm, and two or three birds rise from the ground, the rest rise like a broad and somewhat circular sheet; and if they divide at all, it is done completely; one compact division going one way and one the other, no stragglers being seen. When they settle again, it is with one accord, whether it be in the field or upon the hedge rows. At times a flock will settle upon a tall bush as thick as bees, and chirp away with all their might and main, and at such times so intently are they engaged in their quarrel, confab, or whatever it may be, that one may get almost within arm's length of them, and watch them hop from twig to twig amid a very babel of chirps. When the nearest birds find sufficient time from their noisy conclave to look about them and discover an invader's presence, they rise with a short sharp chirp and fly off without another word, the rest of the flock either dispersing or hieing away to the fields in an irregular and disorderly manner. A dozen examinations of the bushes, in which these unruly conventions had been held, failed, with a single exception, to furnish any intelligible cause, and in that one case there was found a poor escaped and half frightened to death canary bird. The hedge sparrow is destitute of the impudence of the house sparrow, and this is no doubt largely due to the enterprise of that European institution, the crow boy, whose duty it is to perambulate the grain fields to scare away the birds, especially the crows and sparrows, whose earthly happiness appears to be measured by his capability to make unearthly yells produced at the back of the throat and audible a quarter of a mile distant; occasionally a "crow boy" will vary his occupation by inventing an alarm note of his own, the whole sound, however, rarely containing more than four notes.

The English farmer resorts to numerous strategic expedients to rid himself of his superfluous stock of sparrows, one of the most successful of which is to hold a bird net close to a stack of hay or wheat in the winter nights, and placing a lantern near the middle of the net, they beat the stack with sticks, whereupon the sparrows fly to the light and are caught, terminating their tangible existence in the sparrow pie which next day graces the farmer's table.

Returning, however, to the sparrows in the country. They are nearly all house sparrows, and while a sparrow with a white feather or feathers is quite a curiosity in England or France, they are quite common in and about New York city. They form at least five per cent of the whole, while about ten per cent of the female birds have their plumage interspersed with partly white feathers. In the City Hall Park may be seen at any time some sparrows with plumage lighter than others. At Bloomingdale some are seen unusually light. The European sparrow moves with a clean and distinct hop, rising from the ground, and making a perceptible pause between each hop, but the sparrows at Bloomingdale make a succession of quick hops with very little rise, amounting to a short run, and stopping very short, resembling somewhat the movement of the American robin. In fact the result of ten years of observation is that the habits of the American sparrow are undergoing a steady change, and he appears to be entertaining somewhat of disdain for the insectivorousness to which he owes his importation, forgetful that in no other way can he pay his passage money.

SELLING PATENTS BY AUCTION.

A correspondent writes as follows:

To the Editor of the Scientific American :

I notice a sale of patent rights took place in your city on July 16. Can you give me the names and address of the buyers? Or will your paper contain them? L. B. C.

ANSWER.—Our correspondent doubtless alludes to the novel attempt of an auctioneer in this city to establish a regular series of auction sales for patents, similar to the sales of coals and other realized commodities. As might have been expected the attempt has proved a failure, so far as concerns the bona fide sale of patents; but has been a success for the pocket of the auctioneer. The plan is as follows: The auctioneer by extensive advertising requests all who have patents to sell to send the same to him, together with the sum, in advance, of five, ten, or twenty dollars, as the case may be; for which amount the auctioneer promises on a given day, to offer the patent at public auction, and to return the proceeds of the sale to owner less certain additional commissions. Numbers of patent owners have nibbled at this pretty bait, have sent in their patents and money and enjoyed what they paid for—the satisfaction of having their parchments cried out for sale in the rear end of an auction shop; but in the majority of cases there were no genuine bidders. In fact we have not heard of a single example of a bona fide sale. If, however, there have been any real sales, we should be glad to be informed of the exact particulars, in order that we may give our readers the benefit of the facts.

Scattered about the country, there are quite a number of individuals who purport to make themselves useful in selling patents. But like the patent auctioneer, they thrive upon the advance money received from the patentees; the latter seldom or never get any money back from them. If we are mistaken in this statement, if one in a hundred of those who have paid money to these pretended patent sellers have ever through such agency effected a satisfactory sale, or received back their money, we should be glad to learn the names and particulars. The truth is that, in order to sell a patent advantageously, something more must generally be done than to hold up a mere certificate on paper. The public must be very extensively informed about the merits of the new invention; the intending purchaser must have some sort of ocular and corroborative evidence that he can make money if he buys a right; he must see some actual examples of the device; understand how it is made, and at what cost; truthful information concerning the market for the goods must be furnished, etc. To do all this in a proper and effectual manner requires for each patent the undivided time and attention of one or more active persons for a considerable period; and hence, it appears to us to be almost an impossibility for any one individual or concern to make successful progress in the sale of a multitude of patents. The selling of a single patent frequently employs the time of many persons. If there is any one method or agency more effective than another, whereby a patentee, without going to much expense, can find customers, it is by the dissemination of a handsome picture of the invention. Good engravings representing the invention in its various forms and applications, accompanied by lucid descriptions, are almost equal to models or working machines, in conveying information to the public. Descriptive circulars are good in their way; but no matter how eloquent and strong their array of adjectives in praise of the invention, they have little power, and make little impression as compared with graphic delineations; which, if well executed, are pretty sure to command the attention and convince the judgment of the observer. The distribution of these engravings can be readily arranged for by the patentee himself; he has the satisfaction of knowing that every copy sent out is a good seed sown, a step made in the right direction, and all resulting business comes to him direct; but in nine cases out of ten all advance fees paid to the professional patent seller is so much money thrown away.

THE HOWGATE POLAR COLONY.

The schooner Florence, Captain George E. Tyson Commander, will soon sail from New London, Conn., for a voyage to Cumberland Island or some place near Cumberland Island, when the ship's company will form what is known to the scientific world as the Howgate Polar Colony. At the last session of the forty-fourth Congress an effort was made to procure an appropriation of $50,000 for purposes of polar explorations; and though the House Committee upon Naval Affairs reported favorably upon the bill, it was impossible to secure favorable action, and the bill was not passed. Contributions have been obtained from private sources, and the expedition is being forwarded as rapidly as possible. Captain Tyson, it will be remembered, was assistant navigator of the ill-fated Polaris, and escaped on the ice floe. He is peculiarly fitted for the responsibility confided to him. He has been a seafaring man for over twenty years, and a large portion of his life has been passed in the Arctic regions. He is known as a skillful navigator, good executive officer, firm in purpose, cool in temper, and has a well balanced mind.

The object of the expedition is to collect data in reference to meteorology, geology, natural history, and cognate sciences of the polar regions by a system of observations, which will be favored by a permanent location, provided with necessary facilities. Magnetism, astronomy, atmospheric electricity, mineralogy, the question of ocean streams and currents, the phenomena attending the diurnal rise and fall of the tides, velocity and character of the winds, observations upon the vibrations of the pendulum, etc., will engage the attention of the colony when fully established.

Captain Howgate, the projector of the expedition, is an officer of the regular army and is connected with the Signal Bureau. He was selected as one of the committee of investigation on the loss of the Polaris, and during this investigation the present scheme of a polar colony impressed itself on his mind.

CHESS.

The lovers of this interesting and really scientific diversion will be glad to know that one of our valued correspondents, Mr. Samuel Loyd, of Elizabeth, N.J., has undertaken to supply them with a weekly record of chess information, which will be given regularly, until further notice, in the SCIENTIFIC AMERICAN SUPPLEMENT. The first contribution will be found in the current number of the SUPPLEMENT; for particulars, see the table of contents printed in another column.

It is a curious fact, that the most distinguished inventors, mechanics, scientists, lawyers, clergymen, musicians, and statesmen, find recreation in the practice of this superior amusement. There appears to be something about it that both delights the mind and sharpens the understanding. The ablest men are found among its devotees, and confess to its beneficial influences.

Mr. Loyd is well known all over the world as a chess player, and has probably met with as many successes and carried off as many prizes as any other individual. He probably has no superior in chess; a fact that will add interest to the student of the problems that will from time to time be given in our SUPPLEMENT. We may also add that, in addition to the above accomplishment, Mr. Loyd is an inventor and mechanician of superior abilities, a musician of unusual excellence, an artist of peculiar skill, and an engraver of rare talents. The portrait of Dr. Moore is one of his productions- "When do you find time, Mr. Loyd, to execute these art works?" we asked, "I quit work at six o'clock," he said, "and after supper my wife reads, I listen, and at the same time make my drawings."

Manufacture of Lead Pipe, Sheet Lead, and Shot.

Our recent series of illustrated articles, in Nos. 3 and 4, present volume, have attracted much attention. Those who still desire to obtain copies may supply themselves at this office or at any of the news stores.

We are indebted to the Colwell Lead Company, No. 63 Centre street, New York city, John Hooper, President, Lewis Colwell, Treasurer, for attentions to our artists who made the sketches illustrating the making of shot, and for the particulars given, as published in our issue of July 28. The Colwell Lead Company is one of the largest and most enterprising establishments of its kind in the world.

American Institute Exhibition.

The managers have added three medals to the list of awards for the coming exhibition. They are "The Special Medal," "The Medal of Superiority," and "The Medal of Excellence," making in all six grades of medals, four grades of diplomas, and the usual money awards for "perishable products," as flowers, fruits, etc. "The Special Medal" will be offered for certain specified exhibits each year, and each year changed. For the Forty-sixth Exhibition, 1877, which opens September 12th, the following articles only can compete for this award: Pumping machinery, passenger elevators, sewing machines, fire escapes, an approved automatic fire detector, an approved method of preventing alterations of checks, bonds, drafts, and valuable documents, by the use of specially prepared papers or otherwise.

Dangers from Doctors.

Dr. Seaton, medical officer of health, remarks in a late lecture: There are many occasions where the clothes of the medical attendant require disinfection, as, for instance, after visiting a group of small pox or scarlet fever patients. Where the practitioner has been unfortunate enough to have a patient with puerperal fever under his care, the linen requires to be boiled, and the other things baked, before being worn again at a labor. But it is to the hands that he must pay special attention, and it is here that the disinfecting properties of chlorine are particularly useful. The hand should be well soaked three or four times daily in the chlorinated soda (P. B.). If this is done for a week, baths used at the same time frequently, and the clothes disinfected, practice may be resumed without danger. Length of absence will not compensate for a neglect of these precautions, as the practitioner may communicate the disease after many months.

The Rain Tree.

The Consul of the United States of Columbia in the department of Lereto, Peru, has written from Yurimagus to President Prado, informing him that in the woods adjacent to the city of Moyobamba exists a tree called by the natives Tamai-caspi (rain tree) which possesses some remarkable qualities. It is a tree of about fifty feet high when at maturity, and of about three feet in diameter at the base, and has the property of absorbing an immense quantity of humidity from the atmosphere, which it concentrates and subsequently pours forth from its leaves and branches in a shower, and in such abundance that in many cases the ground in its neighborhood is converted into a perfect bog. It possesses this curious property in its greatest degree in the summer, precisely when the rivers are at their lowest, and water most scarce; and the writer proposes that it should be planted in the more arid regions of Peru for the benefit of agriculturists.—*Panama Star and Herald.*

A Two Foot Cheap Railway.

The two feet gauge railroad between Billerica and Bedford is making good progress, and will be soon finished. The passenger cars, now building at Laconia, N. H., will be a decided novelty, as they will have a row of single seats on each side. The road is eight and one half miles long, and will cost about $50,000, or less than $6,000 per mile, being only one eighth the cost of the ordinary railways.

The Deepest Well in the World.

The Warren Farm Well, one of the deepest, if not the deepest, dug wells in the world, was commenced on the South Downs above Brighton in 1858, and after four years persistent digging the water was reached at a depth of 1,285 feet, the shaft being 6 feet in diameter down to 400 feet, and 4 feet for the remainder. The operation cost between £6,000 and £7,000, and was watched with the greatest interest by geologists.

Shad in the Iowa River.

Fly fishers on the Iowa river, at Iowa City, have recently taken several shad, weighing about one pound each. Shad were placed in the Mississippi by the United States Fish Commissioners several years ago, and this is believed to be the first catch in any of the tributaries.

MR. AARON VEEDER, the photographer, of Albany, N. Y., has made a series of interior photo views of Howe's Cave, by means of the calcium light. The stalactite and other formations are quite remarkable.

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[*Continued from first page.*]

of the wire forming the strand lays in the same direction, and is received and held in a groove made around the circumferential surface of the shoe. As we have already stated the two divisions of the strand, being divided by the shoe, are gathered and retained by temporary binding wires. This is well illustrated in Fig. 2. Suppose a skein of thread to be wound upon the hands of a person, one half of the skein would be upon that portion of the hands in proximity to the thumbs, while the other half of the skein, as it passed around the hands, would contact near the little fingers. Gather the two divisions of the skein together, as shown, and bind them with thread, and we have the modus operandi of laying and binding the strands of the cables. The wires passing continuously around the shoes at each anchorage in the same manner as the skein of thread is wound around the hands.

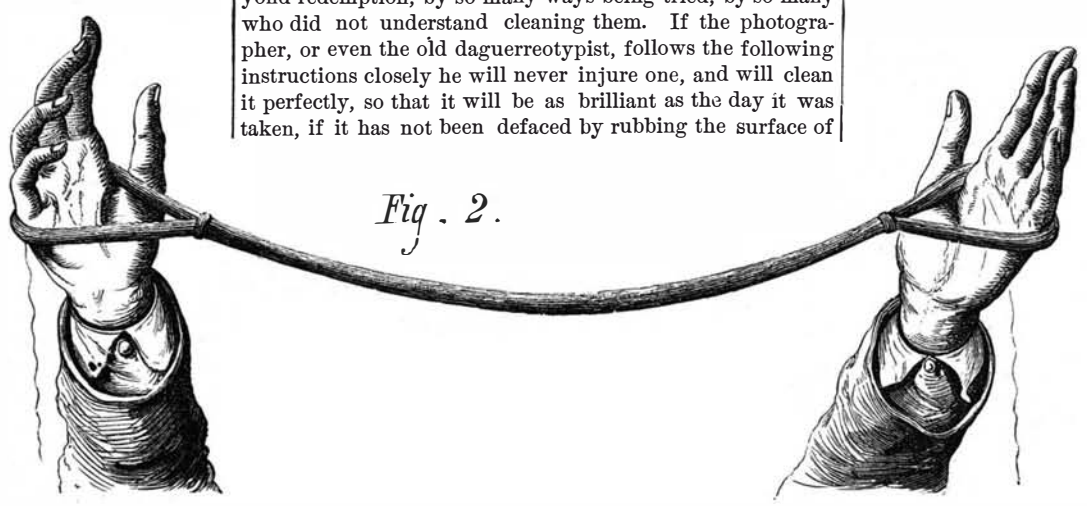

Fig. 2.

HOW THE STRANDS OF EAST RIVER BRIDGE ARE MADE.

The shoe is designed to permanently hold the strand, but its position on the iron bar, as shown, is only temporary and for convenience in laying it. When the strand is complete, two immense wrought iron bars are placed upon each side of the shoe and in juxtaposition with it, and are held firmly in place by means of clamps and bolts. Heavy and powerful tackle, with appropriate blocks and sheaves, is attached to the opposite ends of the iron bars, the wire ropes which pass around these sheaves are then conducted to the engine, and on a strain being taken, the shoe is lifted from the stud in the casting in which it has been held by its curved interior, is raised, turned so that its edges are vertical, is then let forward, thus lowering the strand, and depressed until it can be received between the ends of two of the massive eye bolts, when the pin shown as standing on the eye bolt is inserted in one of the eyes passed through the shoe at the bend and is received in the eye of the bolt that is upon its opposite side. The heavy irons and clamps that assisted in raising it, together with the tackle and blocks, are removed and laid aside until another strand is laid upon its appropriate shoe, to be raised and deposited in like manner between the next pair of eye bolts. A portion of the strands are secured to the lower row of the eye bolts, when another and similar set of eye bolts are placed above this row and their services are brought into requisition in like manner. We may add that these eye bolts are connected by means of a huge pin, upon which they are free to turn like a hinge, to another and similar set, and these in turn connected to others, until the series extends to the foundations of the anchorages, where they are securely held by appropriate fastenings.

In Fig. 3 we illustrate a view of the bridge as it will appear when completed and ready for traffic.

How to Clean Daguerreotypes.

To clean daguerreotypes perfect—so many ways have been published, so many daguerreotypes have been spoiled beyond redemption, by so many ways being tried, by so many who did not understand cleaning them. If the photographer, or even the old daguerreotypist, follows the following instructions closely he will never injure one, and will clean it perfectly, so that it will be as brilliant as the day it was taken, if it has not been defaced by rubbing the surface of it. First, all films, spots, and chemical action can be removed by the following method, and by no other that I have seen published or heard of. Now, bear in mind, the secret is hot water; where it should be used I will state. Second, when a party brings a daguerreotype to you to copy or restore, as they call it, if there are no defects on it, carefully take it apart, brush the surface, crossways the position of the picture, with a fine camel's hair brush, never up and down; then copy it. Third, if there is a film of some or all colors of the rainbow, spots or stains on it, have ready some hot water, cyanide, a pair of pliers, spirit lamp, and some distilled water.

Next, proceed as follows: First, see that the water is filtered and clean, the cyanide also; brush as directed above; then take hold of your plate with the pliers, pour on the hot water first, leaving it on the plate for about a minute, more or less, which softens the film of imperfections that is on the daguerreotype plate or picture. The hot water is the whole secret of cleaning, with the other things mentioned. Cold water may do, and may not, as I have often found out, but hot certainly will. Next, pour the hot water off and pour on the cyanide solution, and it will immediately eat off all imperfections; then wash the picture, and it will become as brilliant as when it was first taken. As soon as the imperfections disappear, which will be in a few seconds, pour off the cyanide solution, and rinse the plate well with distilled water; lime water would spoil the picture—rain or soft water might do; then, with your spirit lamp in one hand and your pliers, holding the plate in the other hand, commence heating the plate from the the upper corners, and blow gently with your breath on the plate till it is perfectly dry; do not stop blowing till it is so, for it is liable to leave a stain where you would stop off blowing and commence again. After this, seal up the picture well with sticking paper, leaving no breaks in it to let in air on to the picture, for that is what causes the defects on the plate, the action of the atmosphere on the gold surface that is over every good daguerreotype picture. Now, you will have as perfect a picture as the day it was taken.

For such jobs we get from one to five dollars, according to the condition and size of picture.—*St. Louis Practical Photographer.*

The Mississippi Jetties.

General Beauregard says concerning the Mississippi jetty system: There need be no fear of the jetty structures notwithstanding the ravages of the teredo, so fatal to all modern structures in the waters of the Gulf. So copious is the alluvial deposit upon the willow mattresses of which the jetties are composed that the wood is protected by a thick coat of mud, and the teredo, which requires free access of salt water to thrive, is balked of its opportunity.

DR. ERASMUS WILSON, an authority in England on cutaneous disorders, has been investigating the number of hairs in a square inch of the human head, and estimates that it contains on an average about 1,066. Taking the superficial area of the head at 120 square inches, this gives about 133,920 hairs for the entire head.

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.—VIEW LOOKING FROM BROOKLYN.

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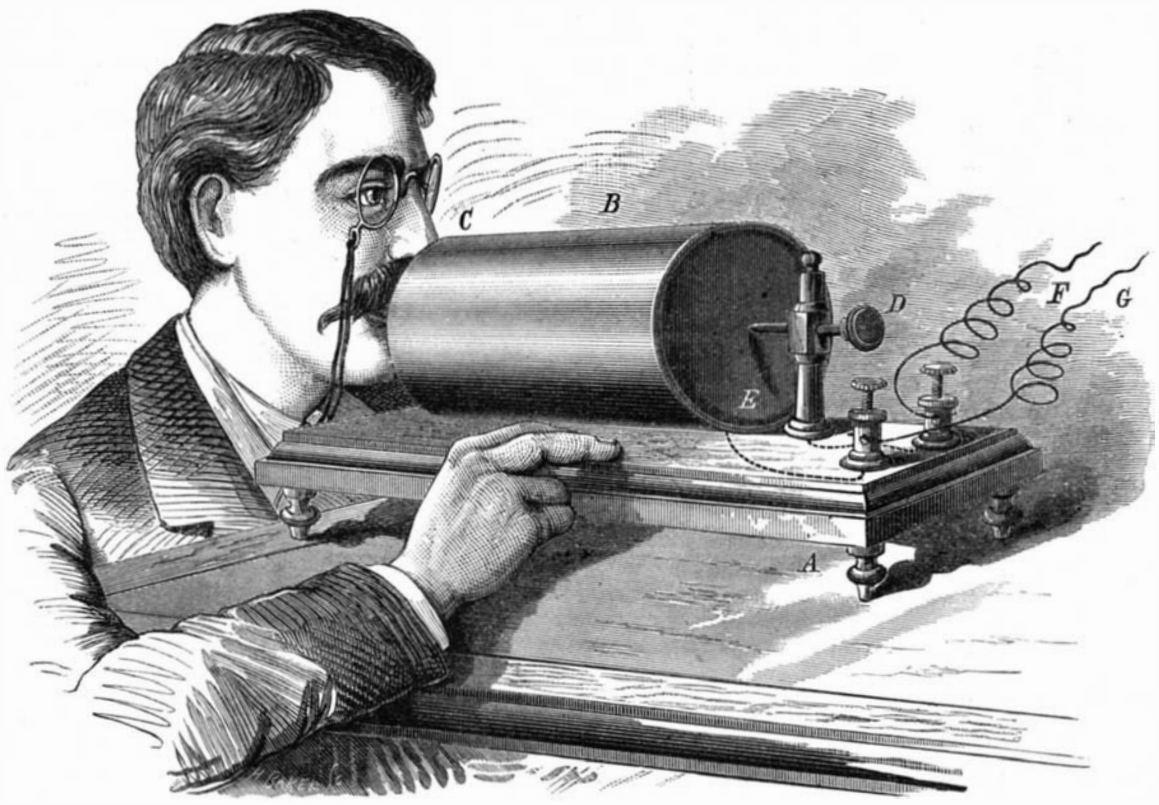
A NEW TELEPHONE.

Mr. George B. Havens, of Lafayette, Ind., has invented a very simple form of telephone, which we illustrate in the annexed engraving. The instrument may be said to take the place of a telegraph key, being operated by the voice instead of the hand, and instead of a message being sent as in telegraph instruments, music is transmitted. It may be applied on any ordinary telegraph line.

The instrument may be said to consist of a metallic cylinder, resembling in size a quart pail, turned on its side, and attached to a block of wood.

By a reference to the engraving, A is the block or base in which the working portions of the instrument are placed. B is the metal sounding box, and may be made of brass, about the size of a quart measure, open at the end, C, and closed at the other end, which serves as a vibrator. In front of E is a metal standard, D, with a platinum-tipped regulating screw, which is in slight contact with the vibrator, E. The main wires, F, G, connect E and D.

The instrument is connected in the main telegraph line, the same as an ordinary relay, and tunes are hummed in the open end of the box, B, and heard from the armature of all the relays in the circuit. In this manner tunes have been sent, so Mr. Havens informs us, for over one hundred miles. In speaking of the instrument Mr. Havens says: "Only the armature of the relays in circuit vibrate. These vibrations are so rapid that the lever has no time to fly back and forth. Often, by holding the relay lever down, the vibrations are much louder, and to find out if the music goes we use the regular key and telegraph instrument. I have also been able to telegraph the Morse alphabet with my voice, by making a long sound for a dash and a short one for a dot. We sometimes throw the relay magnets closer to the armature to make the sound louder."



HAVENS' NEW TELEPHONE.

IMPROVED DONKEY PUMP.

We illustrate a donkey feed pump, from *The Engineer*, which is now being introduced in England. The engravings explain themselves. Fig. 1 is a perspective view, and Fig. 2 a sectional view. There is practically no novelty in the design that requires description, but nevertheless the pump deserves examination.

It has been especially designed for the use of owners of steam launches. It is made entirely of gun metal, and is so light that one quite competent to supply a powerful steam launch boiler can be carried under the arm. It requires little or no fitting on board as it can be bolted down at once and the connections made, and especial pains have been taken to make every portion simple, accessible, and not likely to get out of order. In these respects the little pump is meritorious, and we commend it to the attention of our readers.

Saw Dust Soap.

A manufacturer in Tilsit, instead of adding infusorial earth or ground quartz to the soap mass and thus producing a sapolio, introduces a considerable quantity of very fine sawdust, previously ground and sifted. The wood fiber acts mechanically as a detergent, and besides cleaning rapidly and thoroughly, occasions a saving of one third in the consumption of soap. The soap does not contain an excess of soda, and has no ill effect on the hands. An analysis of a specimen eight days old yielded, grease, 44 per cent; soda, 6 per cent; wood, glycerin, coloring matter, 10 per cent; water, 40 per cent. The price at the factory is about 5 cents a pound.

Progress of American Mechanical Industry.

Details accumulate on all hands in illustration of the fact that the Americans are endeavoring, with characteristic energy, to find world-wide outlets for the products of their mechanical industry. They are not satisfied with having driven our iron and machinery out of their markets by means of a prohibitory tariff, but they are also endeavoring to reduce the demand for our steam engines, our locomotives, and our general machinery in the leading markets of the world. This was to be anticipated as an inevitable result of the great progress which American coal mining has made during the last seven years. Iron and steel of American manufacture have now become so cheap, and are produced upon so large a scale, that they must be worked up somehow; and if the articles into which they are converted cannot find a sale upon American markets, they must be disposed of upon the general markets of the world. This is the conclusion at which Jonathan has arrived, and it is only a natural consequence of the recent course taken by the industrial history of the United States. The circumstances to which we have been adverting appear to us to demand the gravest attention on the part of both the capitalists and the workmen of the Old World. We have always fancied that Belgian competition was a bugbear rather than otherwise. It is true that iron has been produced at marvelously cheap rates upon the Belgian markets, and that some of it has found its way into this country, and has displaced a corresponding amount of English iron. But the competition of Belgian mechanical and metallurgical industry in this important particular—it is comparatively limited in extent, and consequently it does not do us the mischief which some writers have supposed. The case seems wholly different with the American competition with which we are now threatened. The productive powers of the Americans, to whatever branch of human effort they may devote themselves, appear to be only limited by the demand which may spring up for their products. Their supplies of ironstone are practically boundless; their supplies of coal are practically boundless; their supplies of labor are practically boundless. They greatly excel the Belgians in the extent and importance of the mercantile marine, by means of which they are enabled to scatter their manufactures all over the world. They also share with us, apparently, the faculty of developing a world-wide commerce. Under these circumstances, we fancy that it is high time that both capitalists and our workers should be sufficiently impressed with the fact that in dealing with American competitors they have to confront competitors of first-rate ability, energy, and resources.—*London (England) Colliery Guardian.*

Fig. 1.

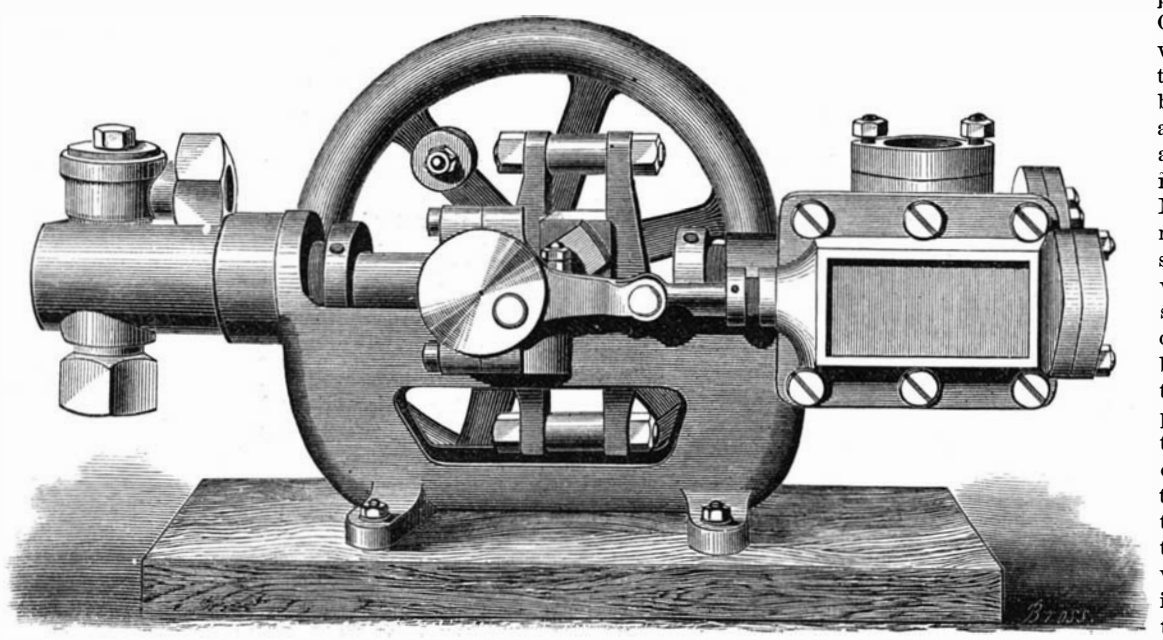
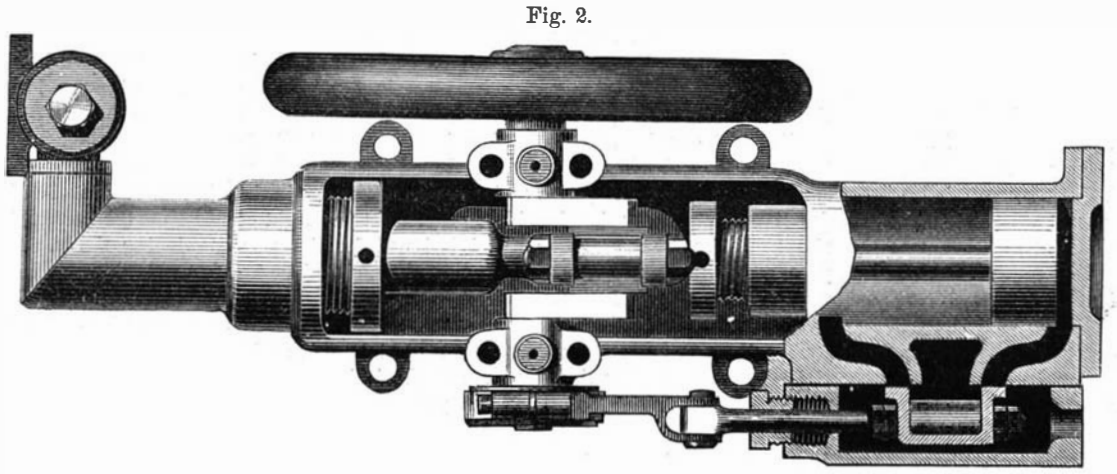


Fig. 2.



LEUPOLD'S IMPROVED DONKEY PUMP.

Motion and Heat.

M. Ollivier (in the *Journal des Débats*) gives the following experiment in illustration of the conversion of motion into heat: One end of a square bar of steel, in this instance 15 mm.×70 or 80 cen., is held by one hand in the middle and pressed strongly against a rapidly revolving emery wheel, by which means the extremity so applied becomes considerably heated. The hand at the middle of the bar does not feel any change of temperature, but that at the other extremity is soon obliged to let go, the temperature rising to the point of burning the skin. M. Ollivier thus explains this effect, which appears paradoxical at the first glance. The heat that burns the hand is not generated at the other extremity of the bar and transmitted from thence, but is produced directly at the place. Movement and heat being synonymous, the movement destroyed by the hand at the outward extremity of the bar by the stoppage of the vibrations is converted into heat, while, there being an interval of repose at the middle of the bar, no heat is perceived. A curious feature of the experiment is that at the outer extremity the thermometer does not show any exceptional temperature, because the thermometer does not stop the vibration. To produce the burning effect, the hand should grasp the end of the bar with force enough to arrest the movement.

The Potato Bug in Germany.

The Cologne *Gazette* says that from careful obser vations and inquiries made since the burning of a potato field in the neighborhood of Cologne it is evident that the object of that destructive process has been completely attained. There is no further trace visible either of Colorado beetles or of larvæ, neither above the soil nor below the surface. There is reason to believe that not one beetle has escaped.

TO MAKE STICKING PAPER.—Brush over your sheets a solution of dextrin, with sugar mixed.

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Communications.

Our Washington Correspondence.

To the Editor of the Scientific American :

The Commissioner of Patents has rendered a decision in the interference between Messrs. Sargent and Little, awarding priority to Sargent. This is said to be one of the most important of all the various applications which the inventor has had before the Office, and he has had many, as it is believed to cover the use of a time lock with a combination lock on the same safe or vault door when each acts independent of the other on the "bolt-work." The application has been in litigation for over two years, and has been in interference with five different applications of various lock inventors, in all of which Mr. Sargent came out the victor.

Mr. Hunt, who was suspended from practice, as mentioned in a previous letter of mine, is making endeavors to have the Secretary of the Interior set aside the action of the Commissioner of Patents in suspending him, and also to compel the latter to allow the reissue patent to go out, about which the trouble originally arose. Hunt's attorneys were heard on Saturday last by Assistant Attorney-General Marble, but up to the time of this writing the decision has not been promulgated. It is understood, however, that he will recommend that the present order of suspension be withdrawn for irregularity, and that a temporary order shall be issued suspending Mr. Hunt until he has shown cause why the order should not be permanent.

I hear that Mr. Hunt takes exception to my statement that his papers were prepared by a brother of the assistant examiner, by saying that he prepared it himself. It is possible that I was wrong as to the actual preparation of the papers; but it is certain that the gentleman mentioned was the attorney in the case, as is shown by Mr. Hunt's own circular; and as the attorney most always prepares the application, my informant had good grounds for supposing that he did so in this case.

An important extension case was heard by the Commissioner on Saturday last, relating to the Voelter wood-pulping patent, which has already had one extension, and is now up for another by order of Congress. The decision has not yet been made, but will probably be given before this is printed.

The State Department has been officially advised that the French Government has reiterated its determination to open the Paris Exposition on the 1st of May next, and that detailed regulations for the information of exhibitors have been published. It is believed that our government will not be able to make any arrangement for American participation until Congress shall have met, there being no law authorizing the appointment of a permanent commission and no appropriation out of which the necessary expenses can be defrayed. I do not hear anything of the provisional commission proposed sometime since.

Secretary Thompson has written a letter to Captain Howgate of the Polar Expedition informing him that he cannot comply with his application that Captain Tyson, now in the service of the Navy Department, should be detailed for the expedition, and that he cannot, much to his regret, comply with Captain Howgate's other request for the loan of instruments belonging to the Navy Department for the use of the expedition. It is said, however, that this will not prevent Captain Tyson going into the expedition, as he has been granted leave of absence for that purpose but without pay. He will command the Florence, and will be paid by Captain Howgate.

The Woodward Expedition has been under discussion by the Cabinet, but I cannot learn that any assistance or official countenance is to be given to this party.

The War Department has issued a general order for facilitating the prosecution of the topographical surveys in the western military divisions and departments—including reconnoisances of routes, the astronomical determination of the positions of military posts, etc., and the drafting of maps—and holding in view uniformity of action and a systematic plan. The general plan of exploration and survey will be determined by the Chief of Engineers, and executed under the direction of the generals commanding by division and department engineers. The results of these surveys will be promptly transmitted to the chief engineers and also incorporated in the general maps of divisions and departments.

Dr. J. D. Hooker, President of the Royal Society of London, and Lieut.-Gen. Strachey, of the Royal Bengal Engineers, have also organized, through the assistance of friends in this city, an expedition for scientific research through the summer in Colorado, Utah, and California, in company with Dr. Asa Gray, of Cambridge, and Professor Joseph Seidy, of Philadelphia, the former celebrated as a botanist and the latter as a comparative anatomist. The results of their discoveries will be communicated to our government in the form of reports, and it is believed that they will be of great value, without involving any expense to the nation, as the costs will be defrayed by the gentlemen who compose the expedition.

Information has been received at the State Department that the International Geographical Conference, lately in session in Brussels, appointed an executive committee to sit in the interval between its adjournment and its future meeting, on which Mr. Henry Sanford was appointed to represent the United States and Sir Bartle Frere as the member for Great Britain.

Our Consul General at Berlin informs the same department that the collection of locks and tools of American manufacture, on exhibition in that city in the building of the Berlin Association of Architects, under the auspices of that body, compare most favorably with other similar manufactures there exhibited, in quality and workmanship, or cheapness, and with proper efforts to introduce them they cannot fail to find an extensive and profitable market in Germany. A collection of American furniture was also on exhibition and received much commendation.

The same department has received a report from our Consul at Sonneburg, relative to the rinderpest. He says the poison of the disease is most difficult to destroy, attaches itself readily to all substances, and may be communicated for an indefinite period, but thinks that there need be no fear that either infected hides or other poisonous articles will be exported to this country from German ports.

The Department of Agriculture reports oats in superior condition in New England, in most of the Southern States, in those of the Missouri valley and in Oregon, and in fair to high condition in all the remainder, except California. The South is finding immunity from loss in their red rust-proof variety. The indications are favorable for a good yield of barley.

An investigation by the same department has been made regarding the loss of sheep, which shows that during the past year a total of nearly three millions of sheep and lambs have been destroyed by dogs, wolves, and disease, of an aggregate value of nearly $8,000,000.

The new Commissioner of this Department (Agricultural) strongly endorses and will give all possible aid for a fair test of the proposed plan for giving, by telegraph and signal cannon, general and instant warning of coming storms, for the benefit of agriculturists during the hay and grain harvests, and also of shipping, and to give warning of sudden destructive floods on rapid rivers. The system has been pretty generally endorsed by prominent citizens, and it is now proposed to lay the matter before the Secretary of War, with the above mentioned recommendations and such others which may be sent by county and State agricultural societies, with the request that he will order a test to be made at all forts, arsenals, navy yards, barracks, etc., in the populous States, so that if successful it may be extended to all the principal towns and villages.

One of Professor Baird's assistants passed through this city on Saturday with 100,000 young shad that were hatched at the South Hadley Falls propagating gardens, to be deposited in the Cattahoochee river, Ga., at Columbus and West Point.

The July returns of the condition of cotton, as stated by the department, cover the entire area of 361 counties, and these counties produce six tenths of the cotton grown in the United States. The average condition of these counties is $93\frac{4}{10}$ per cent, or less by 7 per cent than the average for 1876. The crop is from one to two weeks later, owing to cold in some sections and excess of rain in others. Insects have done but little damage. Labor is said to be becoming gradually more efficient, and an improvement both in *morale* and efficiency is reported from Louisiana.

The appropriations for the navy for the new fiscal year having become available, an order has been sent out for the immediate fitting out of a number of vessels of war, and the work at the navy yards has been resumed. The following vessels are to be fitted out at the places named: The Alaska and Guard, at New York; the Wachuset, at Boston; the Canandaigua and Galena, at Norfolk; the Quinnebaug, at Philadelphia; the Benicia and Troquois, at Mare Island; and the Wyoming, in this city.

The Government has decided that the act of June 18, 1868, declaring that eight hours shall constitute a day's work for all laborers and mechanics employed by the Government, does not prevent officers from making agreements by which a day's labor may be more or less than eight hours; and an order has therefore been issued that officers in charge of public work shall make their contracts and have the work performed upon the basis of ten hours to a day's work, and that all persons who desire to work only eight hours per day shall be paid for that number of hours and no more.

As stated in a previous letter, a number of Parrott guns are being converted into breech-loaders at the Parrott foundry, and the Ordnance Bureau has concluded to adopt the slotted screw—or what is known as the French system—in converting these guns. This system has also been adopted by several foreign governments who, after careful experiments, found it to be the most suitable for converted ordnance.

A new system of signals, the invention of Lieut. Commander Very, of the navy, is about to be introduced, in place of the Coston signal, which has been in use for some time past. These signals have the appearance of Roman candles, in two colors, which by time intervals will indicate the numerals and will enable the vessels using them to have as perfect understanding with each other as with flags in the day time. The Very signals will be projected to a height of about 250 feet by means of a pistol designed for that purpose, and will thus be visible at a great distance. The inventor of the system has given the Government the right to to make and use the signals for five years.

The Treasury Department has made up a statement of the statistics of the wrecks that have occurred within the range of the life-saving service during the past fiscal year, from which it appears that 120 vessels were driven ashore by stress of weather, and that they had on board 1,253 persons, of which 1,214 were saved and 39 lost, or about three per cent of those imperilled. The estimated value of the vessels wrecked is $1,746,464, and of their cargoes $1,348,876, making a total value of $3,095,331, of which, so far as reported, $1,554,505 was saved. Upon fifty of the wrecks the life-saving service apparatus was successfully used and 838 persons rescued through its instrumentality. Notwithstanding the gratifying success shown by the number saved by the apparatus, efforts are being made to improve it by Mr. Kimball, who has charge of the service, and Captain Merriman, the inspector, who has devoted much attention to the subject of extending the range of the shot line; and after a series of experiments at Cold Spring, N. Y., with a new gun and projectile invented by R. P. Parrott (the well-known gun founder), they find that with a gun, which with its carriage weighs less by 20 lbs. than the mortar now used at the stations, and some modification of the line, a range of more than 100 yards additional has been attained for the shot line. The department has ordered 24 of the new guns, which will be supplied to those points along the coast where a long range is required. Addition signals are also being prepared to facilitate communication between the vessels and shore, which will be incorporated into the national code of signals.

The first annual report on the internal commerce of the country has just been printed. It covers a wide range of subjects, that of railroads being treated at considerable length. It is noted that the entire amount of the contributions of the Government, to the close of last year, in aid of railroad construction, including land grants and subsidies to Pacific railways, is only three per cent of the total cost of the railroad system of the United States. The value of our internal commerce is stated to be twenty-five times the value of our foreign trade.

The Chief of the Bureau of Statistics has published a detailed statement of the value of and duties derived from imported commodities which were sold at the Philadelphia Exhibition in 1876, from which it appears that clocks and watches sold to the value of $46,102, yielding $13,208 in duties; china and earthenware sold for $88,429, yielding $40,325 duties; glass and manufactures thereof, $43,706, duties on do., $15,178; gold and silver manufactures, plated ware, and jewelry sold to the value of $51,146, yielding $29,212 in duties; iron and steel and manufactures thereof, sold to the value of $83,615, yielding duties of $29,212; painting and statuary sold for $94,286, and yielded $9,428 (10 per cent) in duties; and manufactures of wood sold to the value $73,371, and yielded $25,680 in duties. The total value sold was $731,593, and the total amount of duties $250, 664.

Washington, D. C. OCCASIONAL.

Expansion by Hardening.

To the Editor of the Scientific American :

It is claimed by some mechanics that steel always increases its dimensions in every direction from being hardened, and this I know to be sometimes the case. On the other hand it is contended that a piece of steel will get larger diametrically but shorter in length from being hardened, and this I have found to be *sometimes* so; but the increase diametrically, in both round and square pieces, is always out of proportion, and greater in amount than is the variation in length. I have taken working gear and refitted it by simply hardening the parts. Very few seem to have any precise knowledge upon this subject, and I recently noticed an article from a person in a mechanical paper who made a gross blunder from want of knowledge. He was speaking of threads and nuts lathed—of their being made to the one thousandth of an inch; he meant well enough, no doubt, but if he ever takes a piece of sheet iron and files at each end of it a V projection, to fit the threads of a tap, and then tries it along the tap in several places, he will divide his thousandths by about 20, for he will find his gage Vs too wide apart in one place and too close together in another portion of the same tap. Neither Whitworth nor the Morse Twist Drill Company will undertake to make a tap with a thread that will successfully stand the above named test, and the man that invents any practical method of making taps that will stand it successfully will leave a mark in the history of mechanism that will live for ages. Has it never occurred to you that it is strange that nuts which are under severe strain come loose upon the threads, although they are not supposed to move at all? Well, the reason is that the sides of the threads of the nut and tap don't fit the dies that cut them; the threads warped in hardening, and so did the tap. No two sets of dies are alike. No two taps are alike. Hence no bolt and nut can fit in the threads with the accuracy that other mechanical fits can be made.

If any one wishes to test this fact, let him take a screw bolt, say 4 inches long, then take a tap and tap a nut having a hole an inch deep, and also a nut having a hole 3 inches deep, using the same tap in each case. If the first nut fits the bolt easy enough to be just turned by hand, ten to one but the second nut will take very heavy pulling with a wrench by the time the bolt projects through the nut. Mechanics are hardening the working parts of machinery more than was formerly done, and nobody seems to take any interest in enlightening us by giving us the benefit of their experience.

Let us take a piece of steel, an untapped nut, for instance, and carefully gage it before and after hardening it; we will find after hardening that its dimensions have increased in all directions, except in the hole, and there the dimension has diminished. This seems an anomaly; for if the surface metal of the outer diameter has elongated, why should not the surface of the hole have increased also? The only explanation I can give is that the metal must expand in the direction in

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which it has the most liberty. The center of the solid metal, between the hole and outside, is the strongest section; and taking that as a line, the outside metal is forced outwards in all directions, expanding the metal outside of that line, while inside of the line it is compressed. The diameter of the hole is reduced in order to make room for the expansion. There must, however, be two such sections or lines, one the center of the strength lengthwise of the metal, and the other the center of the strength diametrically of the piece. If our piece of work had no hole in it, all the expansion would take place externally.

In turning bolts in the lathe many workmen make an allowance for swelling in hardening, and they hit the mark remarkably successfully as a rule, though I never heard of any rule to go by, for it is different in different diameters. Care must be taken to allow little enough, because a hole too small may be lapped out, whereas one too large is a proportionately spoiled job. Small work swells by hardening more in proportion than larger work. What the proportion is, and whether it all increases uniformly, I have never kept any notes to indicate. Wrought iron work acts the same as steel, except that in small work I believe the enlargement to be greater than in large work. Here, however, I may say that by small work I mean work that is three inches and less in diameter, and about six inches long. By large work, say six inches in diameter by about ten inches long, or longer than this measurement. MACHINIST.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

Positions of Planets for August, 1877.

Mercury.

On August 1, Mercury rises at 6h. 3m. A.M., and sets at 7h. 56m. P.M. On the 31st, Mercury rises at 7h. 52m. A.M., and sets at 7h. 20m. P.M. Mercury is small and will not be easily found, but should be looked for after sunset, and late in August, south of the point where the sun sets.

Venus.

Venus is so much brighter than Mercury that it can be seen all through the month of August for a short time after sunset.

On August 1, Venus rises at 6h. 57m. A.M., and sets at 8h. 23m. P.M. On August 31, Venus rises at 8h. 6m. A.M., and sets at 7h. 44m. P.M.

Mars.

On August 1, Mars rises at 9h. 19m. P.M., and sets at 8h. 09m. A.M. of the next day. On the 31st, Mars rises at 7h. 15m. P.M., and sets at 5h. 49m. A.M. of the next day.

Mars is coming into better and better position for evening observation, and will, by the latter part of August, be very conspicuous in the southern sky. Saturn and Mars rise and set nearly at the same time all through the month, Saturn being some degrees above Mars when on the meridian.

Jupiter.

On August 1, Jupiter rises at 4h. 22m. P.M., and sets at 1h. 23m. of the next morning. On the 31st, Jupiter rises at 2h. 23m. P.M., and sets at 11h. 23m. P.M. The best time to look at Jupiter during August will be from 7h. 0m. to 9h. P.M.

On August 1 the largest satellite (according to the *Nautical Almanac*) will make a transit across the disk of Jupiter during these hours, and will not be seen; Jupiter will seem to have but three moons. On the 4th the moon nearest to Jupiter will not be seen because it is behind the planet at the hour from 8 to 9 P.M. On August 9 the smallest of the moons will not be seen until 9 P.M., because it passes in front of the planet. On August 12 the largest moon will not be seen until near 8 P.M., having been in the planet's shadow, and the first or nearest to Jupiter will not be seen until after 9 P.M., having been passing across the face of Jupiter. This same moon is not seen on the 13th until near 8 P.M., because it is in the planet's shadow; again, on the 27th, it is not seen after 8 P.M., because it is behind the planet.

The smallest satellite disappears on the 16th a little after 8 P.M., by coming in front of the planet, and on the 25th it disappears by getting into Jupiter's shadow.

On August 19 the largest satellite will disappear by going into the shadow of Jupiter, and on the 26th it will not be seen between 8 and 9 P.M., being behind the planet.

Saturn.

On August 1, Saturn rises at 9h. 3m. P.M., and sets at 8h. 19m. the next morning. On the 31st, Saturn rises at 7h. 1m. P.M., and sets at 6h. 10m. the next morning.

Saturn and Mars rise at nearly the same time during the month. They are much higher in the southern sky, when they come to the meridian, than Jupiter. On the 2 th, Saturn will be at meridian passage (12h. 57m.) directly above Mars, and have an altitude above the southern horizon of 41°. In the latter part of August, Venus, Mars, Saturn, and Jupiter can all be seen early in the evening.

Uranus.

Uranus can rarely be seen without a glass, but an ordinary telescope will show its disk—it is not at present well situated.

On August 1, Uranus rises at 6h. 13m. A.M., and sets at 7h. 57m. P.M. On August 31, Uranus rises at 4h. 21m. A.M., and sets at 5h. 59m. P.M.

At this time Uranus will be very near the star Regulus. It will not be easy to see it, as its diurnal passage is almost wholly made during the light part of the twenty-four hours.

Neptune.

Neptune rises on the 1st at 10h. 53m. P.M., and sets at 12h. 23m. P.M. of the next day. On the 31st, Neptune rises at 8h. 55m. P.M., and sets at 10h. 25m. of the next day.

The Visual Purple of the Eye.

We have several times alluded in these columns to the so-called visual purple, or *seh-purpur*, as the German physiologist, Boll, terms it. This visual purple is a colored sheet at the back of the retina of the eye, and becomes impressed by light in the same way as a photographic film. The light must, however, be very intense to make an impression, and it was only by exposing a rabbit's eye in a dark room to the action of a ray of light coming through a shutter for three minutes that any image could be produced.

It has been a question how long the visual purple remains after death. Boll found that a rabbit's eye immediately after death was in a position to receive an image quite as readily as when alive, and he asserted that he believed the visual purple to remain unbleached and photographic many hours after death. The German physiologist has been lately able to prove that in the human being such is the case for two hours and three quarters after death, at any rate. The subject in this case was a criminal who was executed in Vienna on the 5th of March last, at a quarter past seven in the morning. The execution occurred in a badly lighted yard, surrounded by high walls, and immediately after death the executioner, as is customary, closed the eyes of the body. Other means were then taken to keep light from the retina, and after an interval of a couple of hours an examination was made by Boll of the eye. A microscopic inspection at once showed the existence of the visual purple, so that the eye still possessed photographic properties, but no trace of an image was to be observed on the retina of the dead man. But even had a slight impression been bleached upon the purple film, say that of the prison wall, this would, nevertheless, have disappeared again, since the membrane behind the retina possesses all the properties of a re-sensitizer, and would have restored the purple color again in a very short time. That the visual purple does not lose its properties till some time after death may now be taken for granted.

So far as regards the possibility of an image existing on the retina after death, so as to be discovered some hours subsequently, we may safely decide in the negative, judging from what we know of the *seh-purpur*. It is only, as we have seen in the case of the rabbit, where the object is very bright, or it is steadily reflected upon the eye for some time, that an image appears; and then the latter must be immediately fixed in alum, as otherwise the mucous sensitizer does its work, and the purple color is restored. No doubt when the eye looks upon a very light object—the sun, for instance—and the vision remains persistent for some minutes, or seconds, afterwards, our eye has received photographic impression, but this not likely to occur just before death. Only under such circumstances would it appear possible to secure a photograph upon the *seh-purpur*, or visual purple of the eye. —*Photographic News.*

A New Fire Cistern.

A new fire cistern, by Mr. R. T. Scowden, City Engineer, was lately tested at the corner of Thirteenth and Magazine streets, Louisville, Ky., and proved to be entirely satisfactory. This cistern is entirely different from any fire cistern ever used before. It is constructed to hold three hundred barrels of water; the body of the cistern instead of being perpendicular is horizontal, lying parallel with the course of the street, cylindrical in form, the walls being of brick and cement, thirteen inches in thickness. The tank is sixteen feet long and ten feet in diameter, with the crown twenty-four inches below the surface of the street, the two outlets being near the ends. The idea of this plan of cistern is to obtain more than one outlet, which is impossible in those now in use, so that a great number of engines can be operated from one receptacle. Another advantage claimed for it is that the cistern, from the nature of its construction, cannot be crushed in from the street above. Every one who saw the test were much pleased, and were ready to acknowledge the superiority of this cistern over those now in use. It is likely that they will be extensively adopted in the future.

Methylated Spirit.

Methylic alcohol, wood spirit or wood naphtha, is one of the volatile products obtained by the destructive distillation of wood, sawdust, spent dyewoods, etc. It is used in a variety of chemical operations, and in the manufacture and preparation for use of certain artificial coloring matters. It having, fortunately, a very disagreeable taste, it is never used for drinking, and hence it may be manufactured, sold, and employed in the arts without any excise interference.

Methylated spirit, however, is a very different article. It consists of ordinary (so-called *ethylic*) alcohol mixed with about five to ten per cent of the true methylic alcohol just mentioned, and is, therefore, not a definite chemical compound, but a mere mixture. The origin and history of this "methylated spirit" may be briefly stated as follows: Methylic alcohol (wood spirit), though very useful to the chemical manufacturer and color maker, cannot be used as a substitute for common alcohol (spirit of wine), but produces different results. It was also found that many chemical operations which require spirit of wine could not be carried on as cheaply in England as on the Continent, where spirit is much cheaper on account of the smaller duty payable on its manufacture. Government was therefore petitioned to grant some relief to manufacturers by remitting the duty payable upon alcohol used in the arts. The result was the concoction of the mixture known as "methylated spirit," which was supposed to be undrinkable, and which, under certain conditions, was to be sold duty free to dyers, etc. Unfortunately the mere addition of wood spirit to alcohol did not seem to the authorities a sufficient precaution. Except a manufacturer or dyer was able to give security in £1,000 not to use or allow to be used the "methylated spirit" for drinking purposes, further additions were insisted upon. One of these consists in dissolving in the spirit a small quantity of shellac. This addition was proposed in the interest of the varnish makers, who it was erroneously supposed would be the main consumers of methylated spirit, and to whom the presence of shellac would be no detriment. In this state the spirit is sold under the name of "finish." This addition, for the color maker and dyer, is one of the most unfortunate that could have been devised. It makes all colors come up flatter, and gives reds especially a dull bluish tone. To detect shellac in methylated spirit it is merely necessary to add a spoonful of the suspected sample to a large glass of pure water, say condensed steam water, and stir up well. If shellac is present it will be precipitated, and occasion a white turbidity or milkiness in the liquid. Sometimes instead of shellac a small quantity of some aniline color, blue or red, is added to the spirit. Whatever color is selected will, of course, in certain cases prove objectionable.

We should suggest that if any further addition to the methylated spirit is really needful—which we doubt—something of an intensely nauseous flavor would be much better than colors or resinous substances.

On the Continent ordinary alcohol is cheaper than wood spirit, and hence purchasers of the latter sometimes find it more or less adulterated with the former. To detect this fraud Riche and Bardy heat the suspected sample with sulphuric acic, dilute with water, and distil. They then mix the distillate with peroxide of manganese and sulphuric acid, thus converting the ethylic alcohol into aldehyde, and add a solution of hyposulphite of soda, and finally some magenta. If common alcohol is present, even to the extent of one tenth per cent, the magenta takes a violet color.—*Chemical Review.*

Blasting by Electricity.

Blasting by electricity, one of the latest practical developments of science, is being generally utilized. The advantages are great saving of explosives, safety, and protection of life, economy of capital and time, and overcoming obstacles that nothing else will, such as firing under any quantity of water, sinking or driving in soft sandstone, granite splitting, rooting up trees, blasting slag, etc.

On Saturday, June 16, a gigantic explosion was arranged in the granite quarries of Messrs. Ellis and Evrard, at Bardon Hill, near Leicester, by Messrs. Atkin and John Harris, of Nobel's Explosive Company; six holes being put in, averaging a depth of 20 feet, each hole being charged with 15 lbs. of dynamite, and exploded with Capt. Brain's electric fuses. The machine used to fire them was Capt. Brain's American Improved, a most compact and simple article, being only some 14 lbs. in weight, which may be used by the ordinary working men, giving an electric spark 2 inches in length. The firing of these six holes had a most marvelous effect, the whole quarry having the appearance of being rent as by an earthquake. Huge blocks of granite were tumbled out, and upon careful examination and measurement it was computed that 14,500 tons had been dislodged and thrown into the bottom of the quarry. This practical demonstration of the effect of simultaneous blasting with a powerful explosive in connection with quarry works was most satisfactory to the proprietors and other gentlemen present, it being generally acknowledged that such successful results had never been known in the district before.

The Electric Blasting Apparatus Company, Cinderford, Gloucestershire, have also just very successfully laid down a set of blasting apparatus at South Kirkby Colliery, near Pontefract, where shafts are being sunk to a depth of 700 yards. The advantages of the system are so apparent in collieries already using this apparatus in the district that its use is becoming more general. At the Houghton Main Colliery, near Barnsley, two 15 feet shafts are each firing 16 holes at once, and raising 70 tons of *débris* from a shot, an increase of 50 tons a blast on the old system—a practical demonstration of the great advantages of simultaneous blasting.—*Mining Journal.*

The English Iron Trade.

The statistics of the iron trade for last year show that out of 4,970,000 tons of pig iron produced in the Cleveland district, 2,828,000 were retained for home consumption, and 2,041,000 tons were exported; and in 1874, 3,543,000 tons of the 5,991,408 produced were retained for home consumption, whilst only 2,587,000 tons were exported. In 1863 the quantity of pig iron made in the North of England was 838,400 tons; last year it reached 2,075,000.

Casualty by Lightning.

The Salem (N.J.) *Standard* states that recently Mr. Henry White, a well-known resident of Lower Penn's Neck, was killed by lightning as he stood in his own doorway. He went to the door to look at the clouds, and as he looked out he placed his hand upon the water conductor, and was instantaneously struck by the electric fluid, which, it is supposed, was at that moment passing down the spout.

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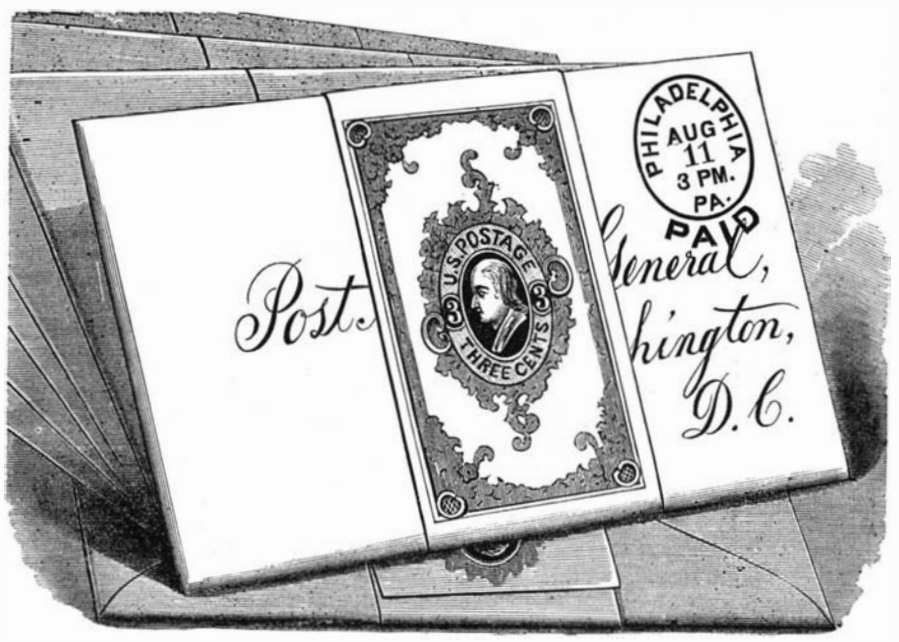
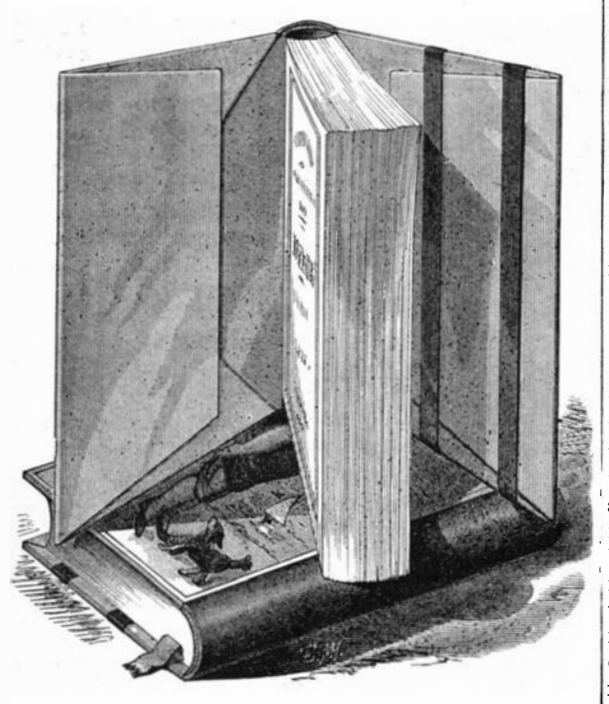
POSTAGE STAMP CANCELLER.

The improvement shown in the engraving consists of what might be called an enlarged non-adhesive postage stamp, printed on strips of paper like labels, gummed at one end and of convenient lengths to encompass the sides of letters or their envelopes, and of moderate width to cover a portion of the superscription and hold itself in position. In use it is folded around the middle of the letter or envelope, the gummed end dampened, and it then forms an encircling band around the letter. It is designed to be retained at the post office, where it is taken off in the act of cancellation. It might with propriety be called a postal notice to the postmaster that the writer had paid his postage. As a portion of the address of the letter is covered by the strip or band, the post office employé removes this band, and by retaining it, it becomes impossible to re-issue such coverings after the first redemption at the post office. If torn or otherwise mutilated, it will be impossible to reunite them, and thus the traffic in washed stamps will be at an end. By no cancelling stamps being employed, the contents of letters are not liable to injury from blows given in using these stamps for cancellation.



POTTS' METHOD OF ATTACHING AND CANCELLING POSTAGE STAMPS.



BOOK COVER PROTECTOR.

Another use may be made with this mode o_ stamping letters. At stated intervals the stamps, as removed from letters, could be forwarded to the accounting officer of the department to tally with the subordinate offices, in connection with mail lists or route manifests, and thus hold a check upon the auditing branch of the services, somewhat in the manner practised in the Treasury Department by means of duplicate invoices.

Application for a patent upon this method of attaching and cancelling stamps has been made through the Scientific American Patent Agency, by Albert Potts, 234 and 236 North Front street, Philadelphia, to whom communications may be addressed.

BROWNE'S BOOK COVER PROTECTOR.

The object of this invention is to provide a temporary cover for books, which may readily be applied to books of varying thickness, but having the same length and breadth. It is designed for children's school books, public and private libraries, to protect these books from the wear and tear of usage, and with ordinary care will last as long as the common book cover.

As shown in the engraving, this cover is made of paper of suitable quality and thick ness, and is folded over the covers of the book in the manner in which covers are usually put on. One side of the folded part is pasted or otherwise fastened. The other half of the cover is similarly folded, and is retained in place by strips of thin elastic rubber extending from top to bottom of the cover. These strips enable the cover to be readily put on the book. Two of these bands are provided, one being sufficient to hold the folds of the cover in place, while the other may be slipped over a portion of the leaves of the book to "keep the place." To fit the cover to books of varying thickness, the two portions or sides of the cover are connected at the back by an elastic band of thin rubber, which is sufficiently yielding to adapt it for the purpose designed.

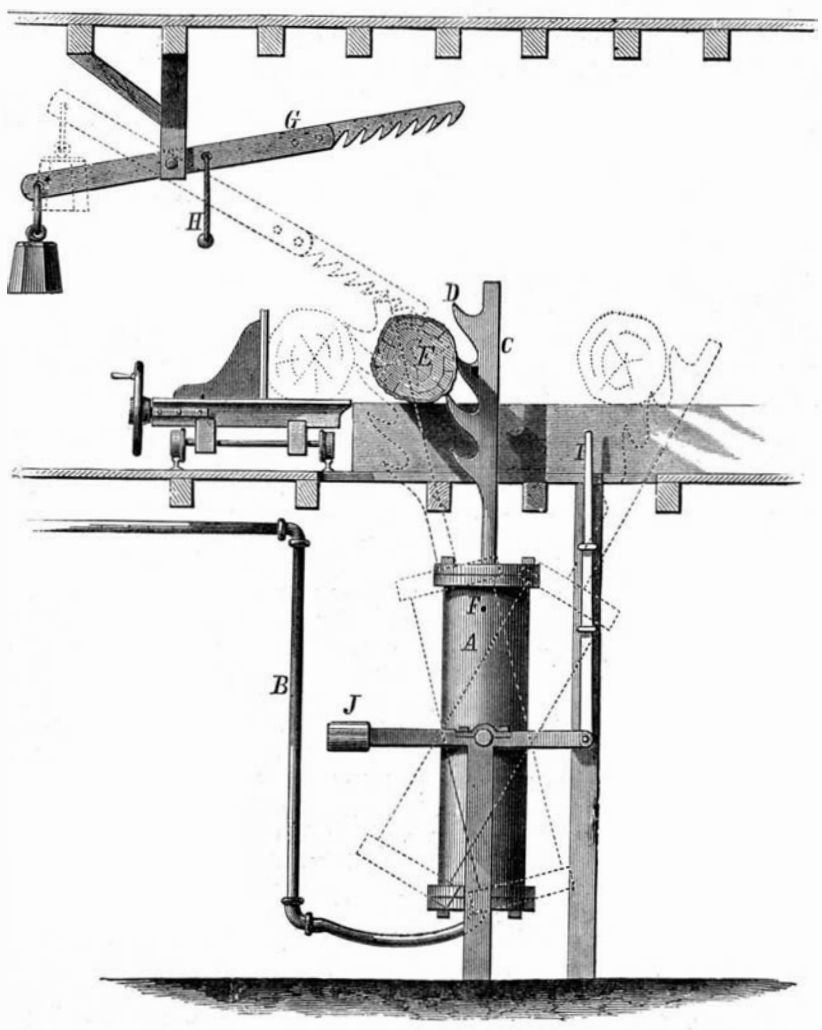
This cover was patented through the Scientific American Patent Agency, July 17, 1877, by Charles B. Browne, of Camillas, Onondaga county, N. Y., who may be addressed at that place, or further inquiry may be made of George W. Keeler, 55 Liberty street, New York city.

IMPROVED LOG TURNER.

Log turners, or "niggers," as they are sometimes called, having a reciprocating toothed bar to work in a perpendicular direction or nearly so, have been known and used for some years for turning logs or cants on the head blocks of sawmill carriages.

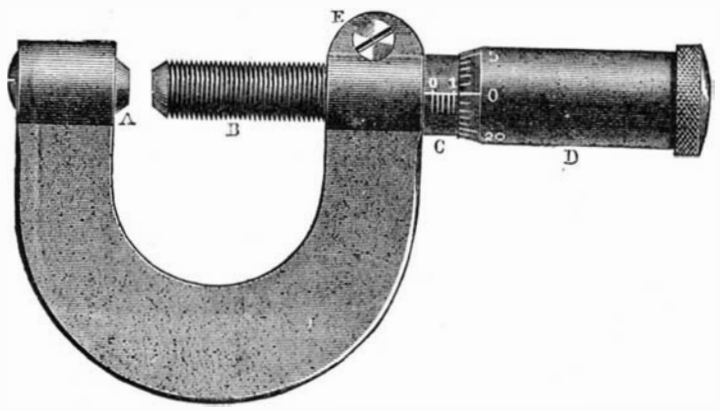
We illustrate herewith a reciprocating oscillating toothed bar that is claimed not only to turn the log on the head blocks, but also to grasp a log anywhere within its reach on the log deck, and turn or roll it forward on to the head block of a sawmill carriage. The advantages are in saving of the time of the man who was heretofore employed in rolling by hand, or by butt wheel and chain, the logs from the log deck upon the head blocks. As the reciprocating toothed bar will, we are informed, work successfully at great angles in either direction from a perpendicular, it will engage a log far away from the head blocks, and force it upon them.

This device is operated through the medium of an oscillating steam cylinder, A, into which the steam is conducted through the pipe, B, and flexible part, into the bottom of the cylinder, when it impinges upon a piston head within the cylinder and causes it and the toothed bar, C, to which it is attached to rise, and as it rises, the teeth, D, of bar, C, engage the side of the log, E, and cause the log to turn over. But in order to take the logs from a distance, from the head blocks on the log deck, the steam cylinder and the toothed bar within it is caused to oscillate, so that the toothed bar will engage a log, and as the steam in the cylinder forces the piston and toothed bar upward and outward, the teeth will engage the near side of the log and cause it to roll over toward the log carriage and head blocks. The toothed bar has a number of teeth upon it that, as the upper one is forced from its hold by the turning over of the log, the next succeeding one engages the log and keeps it in revolution until the piston head has been forced upward and has passed the opening, F, in the steam cylinder, when the steam is cut off, and the piston, with the toothed bar, fall back to their original position. If the log is not yet placed in the desired position on the head blocks, a second or a third action of the steam upon the piston and toothed bar is had until the log is in the right position on the head blocks. In order to hold the log from rolling backward while the steam is cut off and the toothed bar has fallen down for a second action, another bar, G, is pivoted to hangings overhead having a cord, H, attached at the proper place, so that the sawyer can draw the holding bar down upon the log, the teeth engaging it and thus preventing the log from rolling back. A counterpoise is attached to the opposite end of the holding bar, so that when the bar is free the toothed end will rise up out of the way. The cylinder, A, is caused to oscillate by the attendant putting his foot upon the treadle lever, I, and forcing the weighted arm that is fixed to one of the trunnions of the steam cylinder down. This carries the cylinder over to the right, as seen in broken lines, or by raising the treadle bar, I, the cylinder will be forced over to the left, as seen, whereby is given a greater capacity to the log turner. The counterpoise, J, on arm, I, causes the cylinder to assume a perpendicular position when the arm is free from force in either direction.



ORM'S IMPROVED LOG TURNER.

This invention was patented by John Orm, of Paducah, Ky. Further information may be obtained on application to Langstaff, Orm & Co., same address.



MICROMETER CALIPER.

MICROMETER CALIPER.

The accompanying engraving represents a micrometer caliper manufactured by the Victor Sewing Machine Company, of Middletown, Conn. It consists of a U-shaped frame having in one of its arms a screw, A, for correcting the adjustment of the instrument, and in the other a screw, B. The internally threaded part of the frame is elongated, forming a sleeve, C, over which is fitted a sleeve, D, that is attached to the milled head of the screw, B. The sleeve, C, is graduated longitudinally, and the sleeve, D, circumferentially at its lower edge, it being beveled to bring the graduations near the surface of the sleeve, C, to insure accuracy in reading the scales.

Its capacity is one inch, and is graduated to one thousandths, but can readily be set one half and quarter thousandths; and is so constructed that any wear resulting from use can be readily adjusted.

Home-Made Vinegar.

A cheap and wholesome article of vinegar may be made of water, molasses, and yeast, say twenty-five gallons of water, four of molasses, and one of yeast. This, when it ferments, will yield very good vinegar. A fair imitation of white wine vinegar may be made of mashed raisins and water kept in a warm place for a month.

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THE BROWN BAT.

BY C. FEW SEISS.

The brown bat (*scotophilus fuscus*, Beauvois) appears to be the most common vespertilion in the city of Philadelphia. It ceases to hibernate as soon as the first warm days of spring arrive, that is, about the latter part of March or the first of April, but I have, on two instances, observed it flying about at twilight as early as the middle of February. At one time, February 13, 1869, when the thermometer marked 60° in the shade.

This animal, unlike its near relations, the aves, has no need of a nest, and therefore does not construct one. The brown bat has one or two young at a birth, generally the former, and as with the other species, they are placed by the mother amid the fur upon her breast, as soon as they come into the world, where they remain clinging until they are able to fly and provide for themselves. When the mother bat is flying about in search of insect food, or during the day when she is sleeping in some unfrequented loft, clinging head downwards, to a rafter, she always has her baby bat with her.

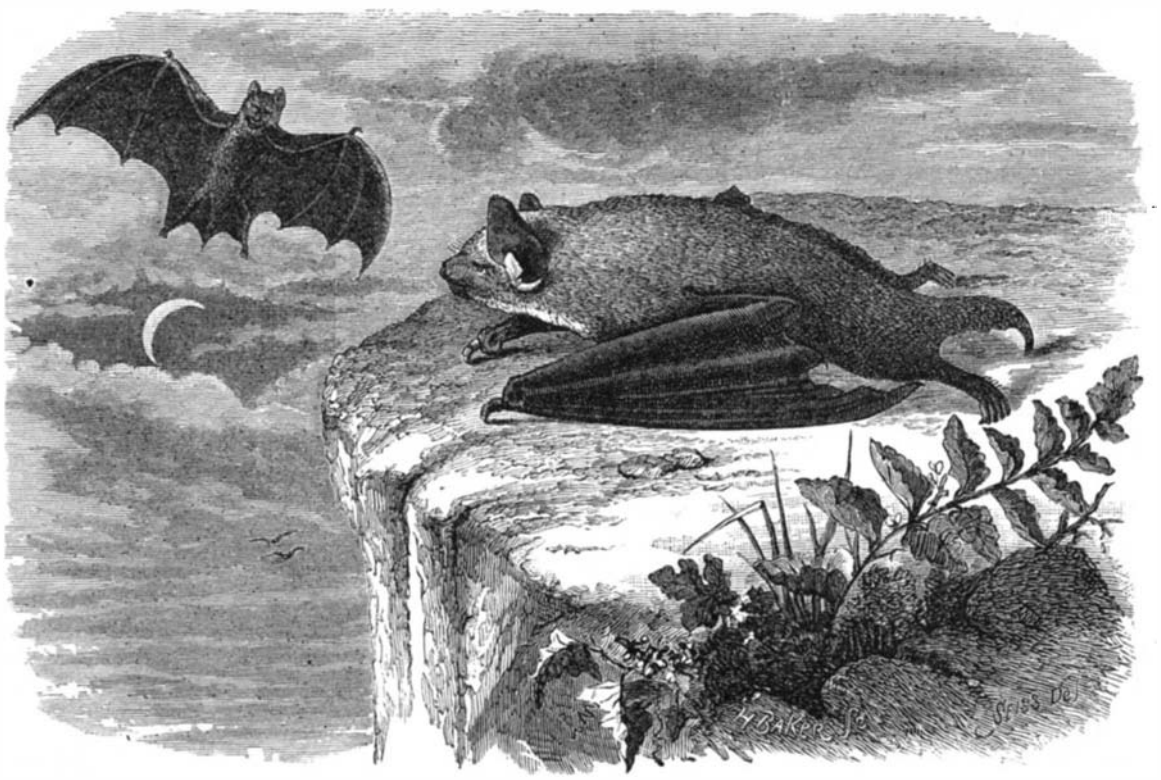
We had a male bat of this species in captivity last spring; I was amused at his actions when placed in the revolving wheel of a white mouse cage, and was surprised to find him able to cause the wheel to revolve quite rapidly; though his gait was indeed ludicrous, being an awkward stumbling waddle. And to add more grace to his motions, he would fall every few minutes, and the momentum of the wheel would carry him completely around, before he could regain his footing. He was an irritable little brute. When any one would touch his cage he would squeak violently, at the same time showing in rage his sharp teeth. He refused to eat all the flies caught for him, and died of self-starvation and thirst combined, in three days after his capture. Therefore as "a cage bird" he was not a success.

Our bat, when on the floor of his cage, rested or moved upon all fours, as represented in the engraving; but seemed to prefer hanging by his feet from the side or top of the cage, head downwards, with his wings folded against his body. He, as with all living bats I ever experimented with, was able to spring up and take wing from a level floor. I state this because it has been asserted that bats can only take wing by dropping from some elevated position, and never from a flat surface.

I once heard a gentleman, who had "gone through college," describe a bat to a lady as "only a mouse with wings." If he had said a little hyena with wings, or better still, a flying mole, his description or comparison would have been nearer the truth. Look into a bat's mouth, and you will observe four sharp canine teeth as in the higher *carnivora;* not four long chisel-shaped incisors, and no canines, as in the *rodentia.*

The dental formula of the brown bat is—

Incisors, $\frac{2 \cdot 2}{3 \cdot 3}$; canines, $\frac{1 \cdot 1}{1 \cdot 1}$; molars, $\frac{4 \cdot 4}{5 \cdot 5} = 32$ teeth.



THE BROWN BAT.

WOOD ENGRAVING IN JAPAN.

The art of wood engraving, which has been brought to such perfection in our day, is comparatively a modern art, at least in our Western civilization, where the earliest wood cut extant dates from 1423. The Chinese, however, have illustrated their printed books with engravings from wood blocks for ages. It is claimed, and we have no disposition to dispute the claim, that their artists during the reign of the renowned Emperor WuWang, who was contemporary with Samuel when he judged Israel, B.C. 1120, adorned the current literature of that day with their wood engravings. They have used pictures cut from wood to illustrate their books for many centuries, and have even during many ages practised printing in colors, which is a recent art in Europe. We say nothing now of the style either of these engravings or painting, for to our taste the drawing is rude, the perspective imperfect, and the coloring brilliant, not to say gaudy; we only give them the credit of having cultivated their artistic talents from an antiquity so remote that our modern art, of which we boast so much, dwarfs almost into nonage by its side.

In Japan, when a wood cut is to be made, the subject is first drawn on a thin piece of paper with Indian ink and a Japanese paint brush. The drawing is then reversed and pasted on the wood, which is not hard like our boxwood, but extremely soft. The paper is oiled and left on the wood till the engraving is finished. All the black lines in the drawing are thus left in relief. The block is then washed and covered with printing ink made of lampblack and glue. The printing is performed by laying a clean sheet of paper on the block and pressing the surface by hand, with a round tool covered with a dry leaf. In this way thousands of copies are printed.

AN example of the large returns which a small invention may often bring in is found in the experience of Mr. Charles Cahoon, who recently died at Portland, Maine—a man of much inventive ability and persistent determination. It is said that he realized $60,000 out of a little lamp-burner, which had an appliance for lifting the chimney so that the wick could be reached for lighting or the mouth of the lamp for filling. This saved the frequent removal of the chimney while hot, and so doubtless prevented many fingers from being burned, and many chimneys from being broken. Simple as was this device, Mr. Cahoon studied hard over it, and nearly lost his eyesight by persistent watching of the lamp flame under different conditions.

A JAPANESE WOOD ENGRAVER AT WORK.

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KNIVES.

In forging table knives two workmen are usually engaged, one of them controlling the piece under treatment with his one hand while with the other he does all the light work, with the aid of a small hammer, his assistant dealing only the heavier blows. In this way the end of a red hot bar of steel rapidly assumes the form of a knife blade, and is separated from the rest of the bar, leaving, however, enough material to furnish the tang of the knife, the part which is secured in the handle, though this is sometimes forged from a piece of iron welded to the steel blade. The elevated portion of the knife between the blade and tang is formed at the same time by the use of the proper mould. A second heating and hammering completes the smith's share in the work. In France, where the knife manufacture has been carried to a high degree of perfection, a method of rolling the knife blanks has recently been introduced, producing excellent results.

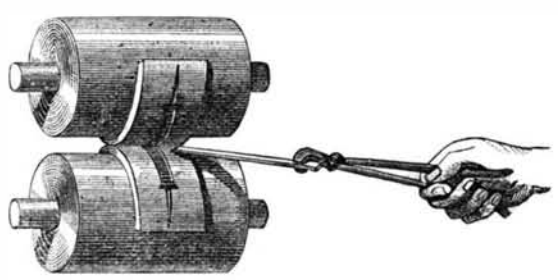


Fig. 1.—ROLLING THE BLADES.

After having been properly hardened and tempered the knives pass finally into the hands of the grinders and polishers. The tangs of table knives are either flat or pyramidal in shape. The flat tangs are placed between the two halves of the handles, and are secured therein by means of several small rivets. The four-sided tapering tongues have a hole drilled for them in the hafts, and are firmly held in place by a cement composed of pitch and brick dust; in the case of knives with metal handles by pouring in molten lead.

Blades for pen and pocket knives are forged in a similar manner from small bars of steel. Their further elaboration —drilling the hole and cutting the notch along the back—is performed after a second heating. In tempering the blades after having first hardened them, they are placed upon an iron plate with their edges uppermost, and heated until they assume the right shade of color.

The accompanying illustration, Fig. 2, represents the more common form of table knife together with an ordinary clasp knife, and its separate parts. Pocket knives are composed of three principal pieces —the blade, the spring, and the haft. The haft is formed of two thin metallic plates, both covered on one side with small sheets of horn, ivory, bone, or other similar material. The blade turns about a small rivet in the upper part of the handle, and bears with its lower extremity against the spring, which is fastened at two places to the back of the handle, as shown in the engraving.

Razor making demands special care and attention on the part of the workman. A high grade of steel, a proper degree of hardness, and a very fine cutting edge are the essential requirements of such an instrument. The blades are forged from flat bars of cast steel as thick as the back of the razor, and the operation is usually carried on by two workmen upon a slightly curved anvil. They are never heated above a dull red heat, in order to prevent any deterioration in the quality of the steel, so that ten or twelve reheatings often become necessary before they are ready for their next stage, their hardening. They are heated, as in the case of the pocket knives, on an iron plate to a bright cherry red heat, and are then thrown, back foremost, into a large vat full of water, in which they are stirred about until perfectly cold. In tempering, the blades are heated in an alcohol flame or in a bath of a molten mixture of tin and lead until they acquire the proper tint of yellow, which varies a good deal with the quality of the steel employed and is only to be learnt by experience. Grinding and polishing conclude the process.

An improved method of making razor blades has lately been patented in England, consisting in stamping them from thin sheet steel and riveting two strong narrow strips upon them, in order to form the back. This process greatly facilitates the manufacture of razors, and is advantageous in more than one respect.

Ancient Aqueducts.

Mr. J. H. Parker, in his book on the "Aqueducts of Rome," gives us some facts which may well put modern municipalities, not to speak of governments, to the blush. The exact quantity of water daily poured into Rome in Trajan's time is known from careful estimates of Frontinus, the head Government surveyor and engineer. It amounted to 24,805 *quinaries*, a section of which amount would be just upon 120 square feet; *i.e.*, in Mr. Parker's words, "we can form some notion of the vast quantity, if we picture to ourselves a stream twenty feet wide by six deep constantly running in at a fall six times as rapid as that of the Thames." It is calculated that, when Trajan's and the Aurelian aqueducts were finished, the daily supply was quite 332¼ millions of gallons; *i.e.*, at least 332 gallons per head, for the population of old Rome probably never exceeded a million. Nowaday forty gallons per head per day are thought ample, and by many excessive; these forty including, of course, all that is used in manufactures, in street cleansing, sewer flushing, etc. The site of old Rome was notably unhealthy, and there was much over-crowding; yet after the chief aqueducts were made, no city of antiquity was so free from epidemics. Another point to which Mr. Parker calls attention is the care with which the best water (such as the Marcian, now lately brought into use again) was kept wholly for drinking purposes, while the muddier and less pure (such as the Anio Vetus and Novus) was used for street and sewer flushing, for the baths, and for scenic representations.

Steel Wire Rope.

Some important trials of steel wire rope hawsers have been lately made at Portsmouth dockyard, the results being such as to astonish the operators as to the enormous tensile strength which had been imparted to the wire. Steel is not entering largely into the construction of our ships of war, but their standing rigging and hawsers are being gradually made of the same light and durable material, and in a short time we may fairly expect that the present unwieldy chain cables in use will be superseded by steel wire cables of moderate thickness and weight. The substitution of the one for the other has long been thought desirable, and after the tests at Portsmouth there can be no longer any doubt of the power of well-tempered wire strands to withstand enormous strains of ground gear. The advantages to be derived from the change are obvious and important. With a chain the safety of the ship depends upon the weakest welding, and when a single link parts, either from inherent defect or from a sudden jerk, everything parts, and the vessel drifts from her moorings. With a wire cable, however, the effect is different. Even when tested to the breaking point timely notice is given of the coming fracture. It does not snap suddenly like a chain, but first one strand, then another gives way, and it is possible for a wire rope to hold the ship even when one half the strands have exhibited signs of distests.

The recent tests at Portsmouth were of various samples of steel hawsers for towing purposes, it having been found from the experience of the Valorous and other ships that a wire hawser possesses equal flexibility to the best hempen rope, combined with less weight, superior handiness, and greater endurance, without any increase in the first cost. Official experiments at Portsmouth have also established the fact that the breaking strain of a steel hawser is more than three times that of a rope hawser. Thus a 9 inch ordinary hawser will break under a strain of 16½ tons, and a 19 inch hawser under a strain of 72 tons, whereas Bullevant & Co.'s 3 inch steel hawser broke at 18 tons, and their 6 inch hawser at 80 tons. In the matter of weight the advantage is also clearly on the side of the steel, the 3 inch and 6 inch wire hawsers weighing 7 lbs. and 29 lbs. per fathom, while the 9 inch and 19 inch hempen hawsers weighed 19 lbs. and 84 lbs. per fathom. Up to the present time the navy has been wholly supplied with steel wire hawsers by Messrs. Bullevant & Co., of London, but the recent trials were made with four samples of steel hawsers submitted for test by Messrs. Scott Brothers, of Bishopsgate Street. Within, the wire of which was made, drawn, and twisted into rope at their works at Nutsford Vale, West Gorton, Manchester. The samples operated upon were respectively of the circumference of 3, 4, 5, and 6 inch. The core of each was formed of tarred hemp, over which was twisted 6 strands, each strand being composed of 19 highly tempered steel galvanized wires. The 3 inch hawser, which was formed of 15 gauge wire, broke at 22⅛ tons; the 4 inch, 14 gauge, at 35⅞ tons; the 5 inch, 12 gauge, at 57⅜ tons; and the 6 inch, 10 gauge, at the enormous strain of 100⅜ tons. In every instance the strands parted at the splicing, which were the only parts displacing any appreciable elongation under the tests.—*London Times.*

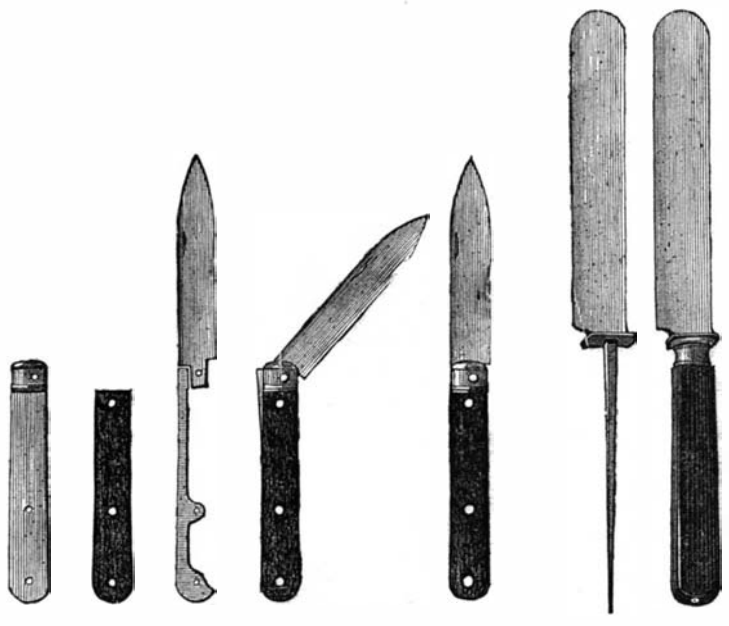
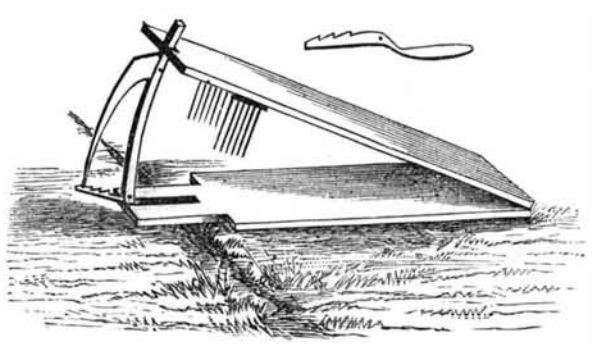


Fig. 2.—TABLE AND POCKET KNIVES TAKEN APART.

EXTERMINATING MOLES.

Mr. Hand, of Sing Sing, N. Y., after trying numerous devices to catch the moles, planned the one represented in the annexed engraving, and finds it very effective. It is made of two boards, an inch in thickness, 7 inches in width, and 2 feet 6 inches long, attached to one end by a broad butt hinge. The bottom board is made with a central slit to admit the free play of the trigger, which is represented in the right hand corner of the engraving; it is of iron, 10 inches long; the lower part 5 inches long, 1⅛ inches wide, and the left end notched and ¾ of an inch wide perpendicularly. The post, 16 inches high, is curved to the circular sweep of the top board on its hinge. The teeth, six in number, on each side, are riveted ⅞ of an inch apart, in a plate 5¾ inches long and 1 inch wide, which is fastened to the board by screws.

The trap is set, as shown in the illustration, across a mole



track, first digging a hole 8 inches square and 6 inches deep, and returning the soil, taking care to exclude all stones and large pebbles. Press the earth down pretty firmly, and set the trap so that the trigger touches the surface of the ground exactly over the line of the track. When the mole goes along his accustomed road, and finds it obstructed, his movement in re-opening the track inevitably heaves up the surface, so as to set off the trigger, and the teeth on one side or the other will catch him. Weight the trap with a heavy flat stone. In taking the mole out, dig down to him on the outside first; for if you simply raise the trap, and he is not dead, the teeth will be drawn out and he will escape, though mortally wounded.—*Country Gentleman.*

The Ribbon Fish.

Frank Buckland, in a recent letter to *Land and Water*, says: "I have received, through the kindness of a correspondent at Nice, a very interesting and remarkable specimen of a ribbon fish. I make him out to be a *regalicus*. I have never before seen one of these most curious fish in the flesh. It measures five feet, is about a quarter of an inch thick, and is of a silvery hue, not unlike the color of the 'silver-hair tail.' Upon the top of the head there are filaments, which, when stretched to their full, are about eight inches long. The head is very remarkable; altogether it is not unlike the shortened head of a horse. The mouth is prehensile, and so peculiarly formed that it is quite worthy of a figure; the eyes are very large and circular; the iris of a lustrous silver color. Behind the head the body is two inches and a half deep, in the middle two inches, at the tail a quarter of an inch. When held up to the light it is almost transparent; the vertebræ can with difficulty be seen, but with the movement of the fingers each vertebræ will give a slight crack at the junction with its neighbor. The vertebræ are longest and thickest towards the tail end, at which there are sharp spines. It is covered everywhere with a fine silvery powder, which readily comes off in the hand. It has a crest of about an inch in height, which runs down the whole of the back. The rays forming the crest are united to double pillars of very slender bone. In substance it is very delicate, and begins to dry and harden almost immediately on exposure to the air.

"I cannot find much about this fish in any of my books. This family of ribbon-shape form consists of seven genera and twenty-six species. Mr. Swainson remarks of it as follows:

"'It contains the most singular and extraordinary fishes in creation. The form of the body, when compared to fishes better known, is much like that of an eel, the length of the body being in the same proportion to the breadth; but then it is generally so much compressed that these creatures have acquired the popular name of ribbon fish, lath, or deal fish. The body, indeed, is often not thicker, except in the middle, than is a sword, and being covered with the richest silver, and of great length, the undulating motions of these fishes in the sea must be resplendent and beautiful beyond measure. But the wonders of the mighty deep are almost hidden from the eye of man. These meteoric silver-coated fishes appear to live in the greatest depths, and it is only at long intervals, and after a succession of tempests, that a solitary individual is cast upon the shore with its delicate body torn and mutilated by the elements on the rocks, so that with few exceptions they are scarcely to be regarded as edible fish.'

"According to this authority, the Mediterranean has hitherto produced the largest proportion of the family, but it is distributed from the arctic regions to the sunny shores of India, so that probably a tithe have not yet been discovered."

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THE WATCH—ITS INVENTION AND HISTORY.

We propose, in this and following articles on the same subject, to give a sketch of the origin of the watch, and to do so shall refer slightly to its elder brother, the clock; but as the early history of clocks has often been given, we do not propose to go over the whole ground of time-keeping instruments, and shall therefore only hint at the successive steps in clockmaking that have led to the invention and introduction of watches.

The first artificial means of noting time was probably a rude species of sundial, to which succeeded the clepsydra and hour-glass. The clepsydra in its simplest form was merely an upright cylindrical vessel that was filled at sunrise with water, which escaped through an aperture in the bottom, its decrease in the cylinder noting the lapse of time. The water was afterwards made to turn a wheel which carried an index round a dial, and many curious automata were thus operated. About the eleventh century it is believed that weights were substituted for the falling water, and a "fly" similar to that still used on the "strike part" of a clock is supposed to have been the usual means of regulating their motion, until the introduction of the balance and escapement, the exact date of which is not known. The earliest balance and escapement of which the actual construction has been preserved is one that was built by Henry de Vick, or De Wick, a German, and set up in Paris, for Charles V., in 1379. It is supposed by some that Vick was the inventor of the escapement there shown, but of this there is no evidence, and for aught we know it was invented and used long before his time. It consisted of a crown wheel, the teeth of which operated on pallets set in a vertical shaft, carrying at its top a cross bar having notches to receive hanging weights. The action of the crown wheel upon the pallets caused a vibrating motion to be given to the bars and weights, in a similar manner to what is known as the verge or vertical escapement, but it was without the hair spring, as this was not introduced until about 300 years afterwards. The rate of going was changed by hanging the weights in different notches in the horizontal bar; and this form of regulating was improved by subsequent makers,who cut threads on the end of the bar and tapped the weights, by which means the latter could be screwed nearer to or farther from the center, and very nice adjustment thus obtained.

The earliest clocks were large machines designed to be set up in monasteries, churches, etc., but succeeding generations saw them gradually made smaller and smaller, until sufficiently portable to be carried from room to room; and near the latter part of the fifteenth century were made so small as to be carried in the pocket, and hence were called by the Germans, who originated this form of timekeeper, "pocket clocks"—a name which they still retain in the German language. They were first made in the city of Nuremberg, and being of oval shape were sometimes called "Nuremberg Animated Eggs."

The first name that has come down to us in this connection is that of Peter Hele, who, it is claimed, some time between 1470 and 1490 (the authorities differ on this point), introduced the mainspring instead of the weight before used, without which it would seem impossible to make a watch, and he should therefore be considered as the first inventor of watches.

The early watches were made entirely of steel and iron. No glasses were used until about 1615, the cases being wholly of metal, and to admit of readily seeing the time, the cover of the face was sometimes perforated in elegant designs. Instead of the form now universally adopted, various styles of casing were employed, such as globular, octangular, cruciform, skull, coffin, acorn, pear, melon, tulip, bird, and, in fact, nearly every imaginable shape that ingenuity could invent, or caprice suggest; and, as a consequence of this and the fact that many of those watches were provided with striking movements, they were so bulky that it was inconvenient to carry them in the pocket, and they were hung at the girdle with swivels so that their faces could be readily turned for observation without being removed from their position. Most watches required winding twice a day, and from their very imperfect escapements could not be depended on as time-keepers—a fault from which it is believed that many modern watches are not wholly exempt. This irregularity of movement in the ancient watches did not depend entirely on the poor escapements, but was due partly to the varying power of the mainspring driving the balance at different speeds, owing to the absence of the hairspring and fusee. This last device was not introduced until about 1525, and was a very important improvement and a great necessity to the early watches before the invention of the balance or hairspring, about 1658. Instead of the chain used in modern watches as the medium between the spring and the fusee, catgut was employed, which was not superseded until about 1660, when the chain was introduced by Gunt, of Geneva.

Both clocks and watches were originally made without minute hands. Many such clocks may be seen in church towers and old houses in Europe, and some may yet be found in the possession of the descendants of the early settlers in this country. When the minute hand was first introduced, it was set on one side of the hour hand, as the second hand is now; and it was not until about 1687 that Quare placed the minute hand concentric with the other, in the manner now universally employed.

The first balance and escapement used in watches were substantially the same as that in Vick's clock, the only essential difference being that the weights were screwed on to the straight bar, instead of swinging in notches. This device retained its position as the only regulator for a watch movement for a long time; but about 1695, the cylinder escapement, in an imperfect form, was invented by Tompion, and was finally perfected by Graham in 1700.

The lever escapement has several claimants, but the earliest style of this device appears to have been invented by the Abbe Hautefeuille, in 1722, and has since been improved by various inventors—Mudge, Litherland, Brequet, Roskell and Savage—until it assumed its present form.

The duplex escapement, in a crude state, is said to have originated with Dr. Hooke about 1658, but its present construction is believed to have been invented by Tyrer, or Dyrer, in 1767.

None of these escapements, however, would have been of much use as isochronous regulators without the balance spring, introduced in 1658, which is claimed as Dr. Hooke's invention. His priority in this matter is disputed by some who claim it for Huyghens, but the weight of authority appears to be in favor of Hooke, who first showed that the vibrations of such a spring are nearly isochronous, although their lengths may be varied with the power of the mainspring. The adoption of this spring marked an era in watchmaking equivalent to that of the introduction of the pendulum into clocks, for without it an accurate-going watch would seem to be an impossibility. It was first made nearly straight, but in 1660, it was improved by making it in the form of a coil.

Shortly after this, in 1676, repeating watches were introduced. This invention, like many others relating to watches, was claimed by two inventors and is interesting to patent attorneys, if not to others, as forming the basis of the interference case of Barlow *vs.* Quare, heard by King James II. in person, March 2, 1687, who decided in favor of Quare. It seems, however, as if Barlow was really the first inventor and that Quare was merely an improver who had succeeded in doing with one push-pin what Barlow had previously accomplished by two. As an example of the ornamental work of that period, the following description of the identical watch made by Quare for the king, furnished by its present owner to the London *Chronicle*, December 11, 1833, may be interesting:

"The outer case, which is of very pure gold, is embossed with the king's head in a medallion, under which on the right is Fame, in the clouds, with a trumpet at her mouth, which is held in her left hand; in her right is a wreath she is raising, as if to crown him. On the left are winged boys supporting the royal crown; under them a tower and fortifications on which a flag is flying; under all is the sea running close up to a fort, and on the sea is a ship under full sail. This case is also beautifully engraved and pierced with scroll work, ornamented with cannon, mortars, shot, flags, etc. The face is of gold, with Roman letters for the hours and figures for the minutes. In the center is a piece of pierced work in gold upon blue steel, showing the letters J. R. R. J., combined so as to form an ornamental scroll, above which is the royal crown. The box is exquisitely pierced with scroll work intermixed with birds and flowers; about the hinge is engraved a landscape with a shepherd sitting under a tree, playing upon a pipe, with a dog at his feet, and houses, trees, etc., in the distance. On the back of the box is the following inscription: 'James II. *Gloria Deo in excelsis sine pretio redimi mini malâ lege ablatum bno. Regi restituitur.*' Within the inner circle is engraved a figure of Justice in the clouds, having in one hand scales and in the other a scepter with which she points to three bishops with an altar before them. On one side of the alter is the tower of London with a group of twenty-six men carrying bags (presumed to represent money): on the other side is a view of the city of London in perspective and a group of twenty-seven men carrying similar bags, of which there are several more lying in the foreground; under all a lion and a lamb lying together.

"The watch is considerably thicker than, but otherwise not much above the common size, and every part of the engraving is beautiful and distinct. It goes accurately, and is in a perfect state of preservation."

In this connection we may state that in 1764 Mr. John Arnold presented to George III. what is believed to be the smallest repeating watch ever made. It is said to have been smaller than an English silver two-penny piece (rather smaller than our silver half dime) and only weighed 5 dwts. 7¾ grains, case and all—the movement itself only weighing 2 dwts. 2⅛ grs. It was necessary to make a set of minute tools on purpose for its construction. For this watch he received a present from the king of 500 guineas (about $2,500), and it is reported that he was afterwards offered a thousand guineas to duplicate it for the Emperor of Russia, but he refused it, so that his gift to the king might remain unique. A smaller watch than this, however, formed a part of the Swiss exhibit in the World's Fair of 1851, but this was not a repeater. It was only $\frac{3}{16}$ of an inch in diameter and was set in the end of a pencil case. It not only gave the hours, minutes, and seconds, but the days of the month also.

The next great improvement in the watch, after the invention of the hair or balance spring, was the compensation feature, and this is believed to have been first applied to watches by F. Berthoud, of Paris, who sold one with this improvement in 1776 through Pinchbeck the London watchmaker, to George III.; but the compensation effected by means of the combinations of bars of metals of different rates of expansion, as applied to timekeepers, was without doubt invented by John Harrison, of Foulby, England, who devoted himself for a long series of years—from 1728 to 1761—to the discovery of a mode of overcoming the change of rate due to the varying temperature changing the proportions of the pendulum in clocks, and the balance wheel, springs, etc., in chronometers.

The compensation pendulum requires but one adjustment to maintain the center of gravity at an equal distance at all times from the axis of oscillation, but the compensation balance is subject to two variations—one owing to the expansion and contraction of the balance itself, and the other due to the varying length of the balance spring, both caused by the changes of temperature. To overcome the change in the length of the ordinary pendulum rod, Harrison invented the gridiron pendulum, but a second invention was necessary to overcome the variation in the hair spring and balance of chronometers, and this he accomplished by combining with the curb which governs the acting length of the spring a compound bar, composed of two metals of varying degrees of expansion, so that the curving of the bar by heat would move the curb and so shorten the spring sufficient to compensate for its own increased length and the expansion of the balance. For these improvements Harrison received the award of £20,000, (nearly $100,000) offered by the British government.

The earliest compensation devices, of which there were several, were applied to increasing or diminishing the active length of the hair spring, but Arnold and Earnshaw invented compensation balance wheels about 1790, and the latter improved them to substantially their present form in 1802.

Jewelling of watches was patented in England May 11, 1704, by N. Facio, of Geneva, who invented a machine for drilling jewels, but it is claimed that Ignatius Huggerford of London had used jewels in one movement only as far back as 1660.

The above is believed to be as correct an account as can be given of the principal inventions that have brought watches to their present state of perfection, but it should be stated that the authorities differ as to the names of the inventors—the same invention being claimed for different men in several instances. We have not attempted to give any of the minor improvements, because a synopsis of these, however condensed, would fill a volume, as there are not less than 450 United States patents relating to watches, to say nothing of foreign inventions in the same line.

The introduction and manufacture of watches, with a description of some remarkable specimens, will form an interesting article, which we shall reserve for our next number.

The Formation of Fat.

It was pointed out by Liebig that the view, once generally held, that the fat of the herbivora was derived exclusively from ready formed fat in their vegetable food. was untenable; he attributed much of the fat of the animal body to the carbo-hydrates of the food. His explanation was combated by Dumas, Boussingault and others, but subsequently adopted by them; and the very numerous feeding experiments of Lawes and Gilbert, commenced about thirty years ago, have afforded strong confirmation of the accuracy of Liebig's conclusions. Voit, in 1865, and still more recently in 1869, and conjointly with Pettenkofer, have maintained that fat is the result of the transformation of nitrogenous substances. They state that they never found fat to be formed from starch or sugar, nor was the carbon stored up more than that in the fat of the food, *plus* that which could be derived from the breaking-up of the albumen. Their experiments, made on the body of the dog, led them to believe that the same must occur with the herbivora; and they contend that, to establish the formation of fat from carbo-hydrates, experiments must be brought forward in which the fat deposited is in excess of that supplied by the food, *plus* that which could be derived from the transformed albumen. Lawes and Gilbert, in a recent paper, refer to the results of feeding experiments with pigs which they published eleven years ago, which experiments clearly show such to be the case. Voit, however, cannot allow himself to consider a transformation of carbo-hydrates into fat to have been conclusively proved by the English experimenters, and suggests several possible sources of error, his reference to some of which, as these gentlemen have found, showing that he has in fact misunderstood them. A careful review, instituted by Lawes and Gilbert, of their feeding experiments with oxen, sheep, and pigs, in order to satisfy themselves whether any doubt could be entertained of the views they had previously advocated, has shown that, as regards the ruminant animals, no absolute proof of the derivation of fat from carbo-hydrates can be obtained; it was quite otherwise, however, in the case of their experiments with pigs, in many of which much more fat was produced than could possibly have been derived from transformed albumen of the food. Instead. therefore, of experimenting further in this field, they have decided, says the *Academy*, to again direct attention to the results given in the paper on the subject, which appeared in the *Philosophical Magazine* in 1866. In the cases to which they refer, where the nitrogenous substance was not so very excessive, but still more than is the most appropriate, there was a considerable proportion of the total fat produced which could not possibly have been derived from the nitrogenous substance of the food. When the proportion of the nitrogenous to the non-nitrogenous substance in the food was the most appropriate tor fattening, there was a much larger proportion (about 40 per cent) of the total fat produced which could not possibly have had its source in the nitrogenous substance consumed.

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Inventions Patented in England by Americans.

June 22 to July 6, 1877, inclusive.

ARCHITECTURAL COLUMNS.—W. H. Drake *et al.*, Chicago, Ill.
BARRELS, ETC.—G. W. Zaraway, Hartford, Conn.
BOOT CRIMPER —J. Smith *et al.*, Boston, Mass.
BOTTLE STOPPERS.—N. Thompson (of Brooklyn, N. Y.), London, England.
BOX DRAWERS.—C. C. Chamberlain, New York city.
BRUSHES AND CURRYCOMBS.—C. E. Holmes *et al.*, New York city.
CAKE MACHINERY.—D. J. Holmes (of New York city), London, England.
ENGRAVING MACHINERY.—H. K. Floger, Boston, Mass.
FIRE ARMS.—H. C. Bull *et al.*, New York city.
FIRE ARMS.—D. C. Holloway, Washington, D. C.
FURNACE.—J. J. Stores (of New York city), London, England.
HARVESTERS.—D. M. Osborn, Auburn, N. Y.
HARVESTERS.—W. A. Wood, Hoosic Falls, N. Y.
LAMP SHADES.—J. J. West, Chicago, Ill.
LETTER FILES.—B. Brower *et al.*, Irvington, N. Y.
MATCH.—W. H. Bracy, Boston, Mass.
MATCH SPLINTS.—E. B. Beecher, Westville, Conn.
METALLIC CAMS.—A. S. Lyman, New York city.
PENCILS.—R. Duncan, New York city.
PRINTING.—H. D. Dupel, Boston. Mass.
PROPELLING STREET CARS.—J. Amboderg, Richmond, Va.
PUMPS.—J. Robertson, New York city.
RAILWAY RAILS.—J. E. Atword, Stonington, Conn.
RAILROAD BRAKE.—H. J. Haddan, Mt Stevens, New York city.
STEAM CARS, ETC.—L. Ransom, Stratford, N. Y.
TELEGRAPH APPARATUS.—E. Gray, Chicago, Ill.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED CARBURETER.

Oliver P. Drake, Boston, Mass.—The object of this invention is to produce a more equal and reliable density of rich illuminating gas when manufactured by the admixture of common atmospheric air and the vapor of hydrocarbons. The invention consists in an improved construction of valve case and valve, and in the arrangement of the valve directly above the float in the partition separating the reservoir and carbureting chamber; also in a device located in the reservoir and resting on its bottom partition, for separating any excess of hydrocarbon vapor from the air passing through the carbureter; also in arranging two or more carbureting chambers, one above the other, in the same case in such a manner that each chamber shall be automatically supplied by means of a float and feed valve.

IMPROVED ICE CREAM FREEZER.

Oliver Dexter, Jr., Troy, N. Y.—This invention consists in means which will forcibly inject currents of air into the freezing can during the process of agitating the contents thereof by dasher blades.

IMPROVED SHOW CASE.

William Shockley, Allerton, Iowa.—This is a case or box for storing screws, screw eyes, or other articles of hardware, of different sizes, for the purpose of preventing any intermixing of different sizes of screws, which forms a source of annoyance in the present open boxes. The invention consists of a case having a number of boxes for the different sizes of screws, each box, except one, being covered by a separate sliding lid, that is guided by side grooves along T rails of one set of partitions. The T rails extend over the greater part of the partitions, with the exception of one end tier of boxes, along which the lids slide laterally, so as to remove the lid from any one of the boxes by sliding first the lateral lids, and then those at right angles to the open box.

IMPROVED POCKETBOOK.

Daniel M. Read, New York, N. Y.—In the construction of this pocketbook the coins are put one at a time upon disks until as many as desired have been put in, or until spring nuts with which it is provided have been fully compressed. The coins are slipped out one at a time, as they are required for use. To the lower part of the case is attached a cover of leather or other material, which is provided with pockets in the manner of an ordinary pocketbook. The cover folds together around the case, and its overlapped ends are secured by a fastener.

IMPROVED BUNG EXTRACTOR.

William J. Wademan, Bay City, Mich.—This invention consists in an extracting rod having a flat arrow-head formed on one end for penetrating and giving a hold on a bung, in combination with a tubular hammer stock for driving the arrow-head of the extractor through a bung. When the head has passed through the bung, it is turned one quarter round, taking a firm hold and allowing the bung to be extracted.

IMPROVED STABLE SCUTTLE AND TRAP.

William M. Watkins, Worcester, Mass.—The scuttle lid rests on sides and ends, so that the whole forms a box. Hinged to the side is the bottom or trapdoor, having the catch that receives a pivoted and right-angled latch. To the latch is pivoted the lower end of a rod, which passes through keepers attached to the side and is used to trip the latch, which is held forward to engage with a catch when the trapdoor is raised into place. A spring is attached to the side and bears against the latch, which is covered by a dust case. The trapdoor is raised by a cord passing over the pulleys pivoted to the forward corners of the free edge of the trapdoor, a lever cam being employed to hold the free end of cord detachably.

IMPROVED TOY BOOTBLACK.

Adolph Gartner, New York city, assignor to himself and Louis Gompper, of same place.—This invention is a toy in which figures perform certain movements by the action of a clock train. The figures are worked by the train, so that the arm of one is operated by a horizontally reciprocating slide piece, and the head of the other by a vertically reciprocating slide piece, forming contact with the pivoted and spring-acted portion of the figure.

IMPROVED SELF-RAISING LARD.

Thomas H. Rosser, Selma, Ala.—This invention relates to an improved compound used for culinary purposes; and it consists in a composition formed by mixing lard, tartaric acid, bicarbonate of soda, alum, and starch.

IMPROVED VENTILATING BUNG.

Simon H. Lesser, New York city.—This invention consists of a hinged and spring-acted bung that is fitted tightly into a seat of the cask and locked by a spring catch or bolt, the bung being provided with a ventilating device for admitting or shutting off the air. It is intended to furnish a bung for the water casks of sea-going vessels, for beer kegs, and other purposes, by which a hermetical sealing of the bunghole is obtained, and air admitted for giving vent at any moment without opening the bunghole.

IMPROVED PROCESS FOR ORNAMENTING GLASS.

Chas. J. Cartisser, New York city.—This invention consists mainly in dispensing with the frosting of the glass by mechanical means, as emery, sand, etc., and producing, first, a prepared surface or ground in clear or whitish color by etching the surface with hydrofluoric acid alone, or by a mixture of carbonate of ammonia and hydrofluoric acid, and laying then on this ground any desired ornamentation by means of a varnished transfer pattern or sheet of lace, or other perforated or cut material, and finally etching this and larger ornaments by one or more baths of carbonate of ammonia and hydrofluoric acid.

IMPROVED CLASP FOR HOLDING NECKTIES.

Alvin H. Dodd, New York city.—This necktie or bow fastener consists of a spring clasp formed from a single piece of wire, bent into loop shape, to receive an attaching plate, having an eye for the reception of the collar button, and provided with outwardly branching ends, to facilitate the entrance and removal of said button.

IMPROVED SADIRON HEATER.

William H. Haylock, Jonesville, New York city.—This invention relates to improvement in sad iron heaters, so that the same may be used at will for heating sadirons, a tailor's goose, or for boiling starch in a convenient manner; and the invention consists of a sad iron heater having a chimney of inverted conical shape, supporting on an angular seat a top for sadirons, or a box top, or a flat pan top, the escape of heat being arranged at the seat and the top parts.

IMPROVED BRUSH.

John Waddell, Elora, Ontario, Canada.—In this invention the brush handle is connected by means of bevel dovetail tenons at the ends of the handle to the brush head, said tenons running in one direction, so as to enter simultaneously corresponding mortises of the bevel dovetail shape of the brush head, into which the tenons are secured by glue.

IMPROVED TOBACCO PIPE.

Samuel H. Thurston, Whitestone, N. Y.—This invention relates to improvements in pipes for smoking tobacco; and it consists in making the entire pipe or portions thereof, or a cigar holder or portions thereof, of pumicestone.

IMPROVED LABELS FOR PLUG TOBACCO AND CIGARS.

George W. Yerby, New York city.—In this invention a plug of tobacco has a portion of a leaf of tobacco, of lighter color than the plug, in which apertures, having the form of letters or characters, are cut, which, when the label is attached to the plug, permit the darker covering of the plug to show, thus making the letters or characters prominent and easily distinguished. Where the label is applied to a light-colored plug it is made from a dark leaf.

NEW HOUSEHOLD INVENTIONS.

IMPROVED VENTILATOR.

Thomas M. Foster, of Union City, Penn.—This invention consists of a number of apertures arranged in the wall and opened or closed by single and double covers, that fit snugly over the apertures, and are operated by a pivoted lever and cords and pulleys. The apertures are provided with thimbles and other weather caps.

IMPROVED SASH BALANCE.

William Cashner, Pleasant Hill, Mo.—This invention consists of the sashes of a window hung by cords to double spring pulleys, turning in opposite directions, and being retained in any position by sliding spring bolts and pins acting on recesses of the sashes. It dispenses with boxes, weights, cords, and pulleys, and is easily adjusted for the weight of the sash.

IMPROVED WINDOW BRACKET.

John F. Zimmerman, Crestline, O.—This invention is designed to furnish a shelf for attachment to window frames to receive flower pots, and is supported by means of arms or bars, which are so connected with it as to admit of adjustment according to the width of different window casings.

IMPROVED BROOM.

James Roney, Scotland, Mo., and Thomas Roney, Hyde Park, Ill.—This invention consists in the combination of a seamless stock, ribbed upon its inner surface, and provided with a screw collar and movable clamps ribbed upon their outer surfaces, and a handle made with a conical forward end, having a screw thread formed upon it. When the handle is screwed down it enters between plates and presses them apart, clamping the filling between their ribbed outer surfaces and the ribbed inner surface of the stock, holding the filling securely.

IMPROVED DEVICE FOR COATING CAKES WITH COCOANUT, ETC.

Daniel M. Holmes, New York city.—The object of this invention is to furnish an improved device for coating cakes made of soft dough, such as jumbles, etc., with grated cocoanut, sugar, currents, and other substances, which will enable all the cakes to be coated evenly, and will prevent any of the cakes from being flattened. The invention consists in the watertight box provided with a flexible waterproof sheet, a water pipe, and air passages, to adapt it to be used for coating soft cakes with cocoanut, sugar, etc.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED AXLE BOX.

Isaac Newton Camp, Deerfield, Mich.—The axle is inclosed at the hub-section with a revolving box provided with outer spiral grooves or channels, and, if desired, an inner returning groove for oil. The groove or grooves are provided at suitable distances with perforations through which the oil passes to the axle to lubricate the bearing of box and axle.

IMPROVED COMBINED CUT-OFF AND FILTER.

John Hoover, Crawfordsville, Ind.—This invention relates to a cut-off and filter combined, which may be used so as to conduct first the dirty water from the roof out through the waste pipe, and passing then the water through the filtering chamber, in which the filtering material can be readily replaced, as required. The invention consists of a cut-off combined with a filtering device, the partition between the cut-off having vent holes to pass any surplus water.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN PLANTER.

Charles McGee, Elwood, Kan.—This improvement is in that class of cultivators which are constructed in duplicate form with shovels upon separate beams arranged to cultivate upon both sides of a row at once, which beams are connected by a loosely jointed elevated coupling high enough to permit one set of shovels to be advanced or retracted independently of the others. The improvement consists in arranging upon each beam a nicked shovel combined with centrally arranged cutting blade, which arrangement more perfectly cuts the grass and clears the shovel.

IMPROVED ROCKING DEVICE FOR HARVESTERS.

Edward Cheney, Geneva Lake, Wis.—This invention relates to means for tilting the cutting apparatus of reaping and mowing machines; and consists in combining, with the drawbar and slotted shoe of the finger bar, an adjustable cam or slotted wedge and a hand lever, whereby the attendant can tilt the cutting apparatus, and give it any desired angle of inclination.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SPIRAL CAR SPRING.

James Ludlum, Pompton, N. J.—This invention is a spiral spring made from a metallic bar, whose cross section in its exterior surface is convex, and the two interior ones more or less concave, while the upper and lower edges of each spiral are rounded off. The spring thus formed is capable of resisting a great amount of pressure, while it is also capable of yielding laterally, and as the coils overlap each other they are mutually supported.

IMPROVED FEED REGULATOR FOR MILLSTONES.

James W. Moir and James H. Ellis, Halifax, Nova Scotia.—This invention consists in the combination of a valve connected with the end of the grain conduit, a spring for holding the valve open, and a hopper that is suspended from the valve, through which the grain passes to the hopper of the millstone. The grain, by weighing down the hopper, moves the valve so as to control the amount of grain passing through it.

IMPROVED SPINDLE FOR LOOM SHUTTLE.

James Hamilton, Salmon Falls, N. H.—This invention consists in a spindle which is made of two parts, and applied in the shuttle by means of independent pivots, arranged in such manner that when these parts are raised to introduce the cop they will be contracted, and when they are adjusted in position for weaving they will expand and firmly hold the cop.

IMPROVED ROAD SCRAPER.

Ahira Thompson, Harmony, Ill.—This invention consists in the combination of bar, perforated plates, and draft bars, with scrapers and running gearing of a wagon; and in the combination of loops or keepers, chains, levers, crossbar, and the standards, provided with hooks, with scrapers, and with bars, attached to the running gearing of a wagon. It is so constructed that it may be attached to an ordinary wagon, which will work upon even or uneven ground, and can be adjusted to scrape wide or narrow, light or heavy, light upon one side and heavy upon the other, and light or heavy upon the inside, and heavy or light upon the outside.

IMPROVED ROPE OR LINE CARRYING PROJECTILE.

Thomas C. Backus, Brooklyn, N. Y.—The object of this invention is to furnish, for the purpose of establishing connection with the upper stories of burning buildings, an improved line or rope projectile or conveying device, that is shot, in the nature of the line-carrying balls or rockets in coast wrecking apparatus, from a gun or other implement, to carry a line to the endangered persons, and admit the hoisting of a hose, rope ladder, or other fire-escape. The device may also be employed as a safety device on board of vessels to convey the line ashore.

IMPROVED WINDMILL.

William G. Alexander, Winnemucca, Nev.—This invention consists in a windwheel in which the fans are divided longitudinally into two equal parts or sections, hinged to each other at their adjacent edges, and having one section rigidly attached to the arms of a wheel; in the combination of spiral springs with the hinged parts or sections of the fans; and in the combination of rods, a small sliding wheel, a sliding rod, and a cord with the hinged sections of the fans, and with a wheel shaft and turn table.

IMPROVED SAW GUIDE.

William Collins, Perham, Minn.—This saw guide is extended to the end of its frame, and is provided with a screw at the long end of a lever, whereby the sawyer need not let go his feed lever, and may adjust with more facility.

IMPROVED CAR MOVER.

Daniel Pierce, Brownington, Vt.—This invention is a device for moving freight and street cars on railroad tracks, and may be also used for hoisting and other purposes. It consists of two cogwheels, arranged in fixed position, but with teeth at opposite direction to each other, on the car axle or shaft, the cogwheels having circumferentially grooved side disks for a detachable yoke frame carrying lever sockets and pawl. The cogwheels are intended to be attached to the axles of each car, forming a stationary fixture of the same.

IMPROVED SCROLL SAWING MACHINE.

Franz Eisendick, New York city.—This invention consists of a lateral saw frame that is guided on top and bottom rails, and made adjustable to different lengths of stroke by a radially slotted and adjustably weighted crank disk. The upper saw clamp is raised or lowered by a screw rod and set nut for the length of the saw, and the tension adjusted by a sliding wedge key. A pan below the saw serves as receiver for the sawdust.

IMPROVED MACHINE FOR MAKING PICKER TEETH.

Robert Aldrich, Millville, Mass.—This invention produces shoddy picker teeth from metal rods by a process of swaging; and the nature of the invention consists in rotating swaging dies adapted to give the desired shape to the picker teeth in combination with a punch which is applied to a horizontal reciprocating stock.

IMPROVED RAILROAD GATE.

Elias W. Moyer, Bernville, Pa.—This invention is to furnish railroad gates which shall be so constructed that they will be opened by the wheels of the approaching train, and will close automatically as soon as the train has passed. The gate is formed by attaching parallel bars to a shaft, which rocks in bearings in bars attached to the ties. The wheel of the advancing car strikes either end of a spring, and the effect is to push the spring and bar before it, bringing the levers and gate into an inclined position, so that as the wheels advance upon the spring and bar they force them downward, bringing the levers and gate into a horizontal position. As the wheels pass off the spring and bar, other springs draw the levers into a vertical position, raising the gates.

IMPROVED SPINDLE.

Gilbert P. Whitman, Rockport, Mass.—This spindle is intended to steady the bobbin without driving the same, so that high speed without vibration is obtained. The invention consists of a fixed standard supporting a small spindle loosely at the top, revolved by a combined cup, whir, and sleeve, and lubricated by an oil cup at the base of the post, provided with a dished cap or drip cup. A bulging collar is fastened to the post above the whir to prevent raising of oil, facilitating seating of bobbin, and prevent whir from rising.

IMPROVED RAILWAY AXLE BOX LID.

Francis C. L. G. Susemihl and Herbert H. Hewitt, Detroit, Mich.—This invention relates to the covers of journal oil boxes for railway cars; and it consists in a cover or lid having projections formed on its edges that are received by grooves formed in flanges that project from the sides of oil box. The cover cannot be lost, as it can only be removed from the box by removing the box from the truck; and it cannot easily be broken or disarranged.

IMPROVED COMPOUND STEAM BOILER.

Robert R. Hine, Kohala, Hawaii, Hawaiian Islands.—This invention is a compound boiler, designed to use cane trash or other light fuel. It consists in the combination of a single flue boiler and a many flue boiler, placed end to end, with a space between them, and connected together by a steam drum and circulating pipe, with each other and with the furnace and chimney.

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Ground Mica—H. Lawrence, 148 Mauger st., Williamsburgh, N. Y.

Boiler Incrustations.—Wanted a first-rate house to introduce a new Anti-Incrustator, solving completely the question. Address, Wirth & Co., Frankfort on Maine, Germany.

Wanted—A chemist by a western chemical factory. Must be well posted in volumetric analysis. Address, with references, H. W. H., P. O. Box 875, New York city.

The Best Ice Machine ever made was recently patented by Major D. L. Holden, and will shortly be illustrated in the SCIENTIFIC AMERICAN. Address, D. L. Holden & Bro., Beach & Palmer Sts., Philadelphia, Pa.

For Sale—Entire interest in Patent Self-Measuring Fluid Can. Satisfactory reasons for selling. Address, Box 143, Geddes, N. Y.

Wanted—Brown & Sharpe's Universal Milling Machine. Must be in good order, and cheap for cash. Address, A. V., 159 William St., Newark, N. J.

Wanted—To purchase a second-hand Disintegrating Mill. Please address, stating size and price, J. O. & E. Smith, So. Canterbury, Conn.

Good Second-hand Steam Engine, cylinder 12 x 24 in.; flue boiler 40 in. x 25 ft.; smoke stack and connections complete; for sale cheap. C. S. Green, Roaring Branch, Lycoming Co., Pa.

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Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

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Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

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For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence. R. I.

Notes & Queries

E. W. E. is informed if you will send some more particulars, to make your meaning plainer, we will endeavor to answer the question concerning forging crank axles.—S. L. N. F. is informed that we have already published so much on the "snake" question that we feared to bore our readers. We have received many letters on the subject, and every week adds to the number.—C. B. R., W. D. Z., W. E. D., and others.—For directions for making rubber stamps, see No. 13, vol. 25, p. 203 (26).—C. R. is informed that Mr. Rose has not yet published such a work. The information you desire can be gained by reading the Nos. of the SCIENTIFIC AMERICAN containing the articles you are interested in.—J, W. W.—Apply to a physician.—W. E. D. asks for a recipe to make eggs of Pharoah's serpents, and is referred to vol. 34, No. 14, p. 218 (2).—E. L. R. is informed that we are not very favorably impressed with the design of his engine.—R. C. of Canada is informed that he should use gearing in his machine in place of the lever.—S. E.'s inquiries have already been answered.—To inquiry of J. D. about balloons we refer him to p. 64, vol. 32.—W. L. is informed that his calculation of his hay press is correct. But he will not realize all the pressure, in practice, as some will be required to overcome friction of moving parts.—K. Bros. are informed that the question of grate bars can only be answered by themselves. Measure the water and coal used by each boiler in a given time.

(1) M. M. C. says: I wish to make a number of wheels of sheet brass about 3 inches in diameter with a flange ¼ inch wide turned over so as to be at right angles to the web of the wheel. On one edge of this flange is to be ratchet teeth about $\frac{1}{10}$ inch apart, and on the face are to be figures stamped into the brass. Can I stamp out the teeth and figures and then turn the flange over with rollers without impairing the uniformity of the teeth? A. It would be better to turn the flange and then cut the teeth with a wheel-cutting engine or some fixture adapted to that purpose. If the figures are marked before the teeth are cut, there is no danger of injuring by spreading of the metal with figure dies. 2. Can light brass articles be cast in iron chills successfully? A. Use sand for casting small articles.

(2) W. M. asks: Is there anything that will insure or give to steam-heated tar (gas tar) drying qualities? We find it necessary to return our small chain, after tarring, into a steam chest in order to make it, when cold, sufficiently dry to handle. This is objectionable in view of cost, also detrimental to the appearance of chain. A. We know of nothing. Perhaps some of our correspondents can give the desired information.

(3) J. T. asks: 1. What kind of metal is best for what is called a buzz, such as is used for cutting the twisted part of augers? What is the speed required for such a wheel? A. If you have reference to what is called the "tit" or tip of the auger, it is done on a steel wheel running at high velocity, say from two to four thousand per minute, dependent on the size of the wheel. 2. Have casehardened journal boxes ever been used for a high speed with advantage? A. Yes.

(4) C. J. M. asks: 1. Is there a rule for figuring cone pulleys? Is it necessary to know the distance from center to center? If so, why? A. C. J. M. will find his pulley question fully explained in "Wrinkles and Recipes." 2. I am building an engine, and I have two narrow rings with break joints on the piston head. Should they be turned the same size as the cylinder? A. Turn the rings rather larger than the cylinder bore and spring them in. 3. What kind of metal is best for engines and pump rings? How should the joints be made? A. For piston rings cast iron. For pump rings brass.

(5) C. Y. & Co. ask how to copper plate iron castings. A. A cheap method of covering articles of iron with a film of copper without the use of a battery is to clean them and immerse them in an acidulated solution of sulphate of copper, and clean by washing in water. The solution may consist of 3 lbs. sulphate of copper dissolved, and add 2 fluid ozs. of sulphuric acid.

(6) J. E. B. asks for a recipe for the manufacture of parchment paper? A. Dip white unsized paper for half a minute in strong sulphuric acid, and afterward in water containing a little ammonia. Another process is to plunge unsized paper for a few seconds into sulphuric acid diluted with half to a quarter its bulk of water and wash with weak ammonia.

(7) W. H. asks: What is the best fertilizer for celery? A. Apply to some gardener in your vicinity.

By what process could I extract gelatin from buffalo hide or cow's hide? A. See "gelatin" in Appleton's "Cyclopædia."

(8) W. T. W. & Co. ask for information about polishing axes? A. The polishing of axes differs immaterially from other kinds of work that is finished on emery wheels. After the axes are ground, a piece of wood is inserted in the eye to conveniently hold it, and then it is held upon a common emery wheel (made of wood covered with leather and coated with glue and emery). A similar wheel covered with a finer grade of emery is used, and the finishing done on a still finer wheel covered with flour of emery being used. Some axe makers use but one grade of wheel, and varnish the work to prevent rust.

(9) R. S. R. says: I wish a recipe for making bird lime? A. The middle bark of the holly is gathered in June and July and boiled for 6 or 8 hours in water until it becomes soft. It is then put in a heap underground for 2 or 3 weeks, being watered if necessary, and left to ferment until it assumes a mucilaginous state. It is then pounded and kneaded until all refuse matter is worked out. To preserve it, it is kept in an earthen vessel and covered with water.

(10) J. G. asks: What is the Banting system of reducing flesh? A. Mr. Banting reduced his weight by leaving off eating plain bread, potatoes, fat meats, pastry, sweets, salmon, pork, and veal, and restricting his diet to fish, corn beef and mutton, toasted bread or crackers, and fruit. He drank nothing with milk or sugar in it, no wine but claret, and no beer.

Will the cistern water from houses on which pigeons light, after being passed through sand and charcoal, retain any disagreeable odor, or be injured in any way? A. No.

(11) P. B. asks: Will the water rise in a tube or vacuum 4 or 6 inches in diameter as well as 2 inches? A. Yes.

(12) F. L. asks: Who is Mr. Joseph Saxton whose name appears as one of "Our Men of Progress?" A. Joseph Saxton was born at Huntington, Pa., March 22, 1779, died in Washington, D. C., October 26, 1873. In his youth he constructed a printing press and issued a small newspaper. At the age of 18 he went to Philadelphia, where he found employment with a watchmaker and afterwards with an engraver. His first invention was a machine for cutting the teeth of chronometer wheels. Afterward he constructed the astronomical clock, with compensating pendulum, now in the State House. He constructed many other machines and appliances, but these mentioned were considered sufficient to give his name a place among "Men of Progress."

(13) I. L. B. asks: Can you tell me how to clean postage stamps for a collection? A. We must decline to publish recipes for cleaning—removing postmarks, etc.—postage stamps, as it will be obvious that information of this would be taken advantage of by unprincipled persons to defraud the Government. The gum may be removed by soaking in a large quantity of water, and pressing between pieces of filter paper—this will also remove most of the grease and other stains and tend to brighten the colors.

(14) D. F. H. asks: 1. What kind of steel is used for making shoe knives? A. Good cast steel. 2. What oil is used for hardening? A. Any animal oil. Lard oil is generally used. 3. How is the temper drawn, and how low? A. Till the bright surface assumes a red or copper color.

(15) E. H. asks: What ought to be the size of a blower fastened on a 4 inches axle making 85 revolutions a minute, to produce 40 lbs. of pressure, the diameter not exceeding 18"? A. We think it will be necessary to use a positive blower, and the size will depend on the quantity of air you wish to use.

(16) D. B. K. asks if the bearing surface of two hardened globes of 25 feet diameter is greater than two globes of 1 inch diameter? A. If the globes are perfectly hard they will only have a point in contact, whatever their size. In practice, however, if one globe was resting on the other, we think the bearing surface would be greatest for the large globe,

(17) J. P. L. says: How can I compute the thickness of iron or brass in a hollow sphere necessary to stand a given pressure per square inch, the pressure to be applied within? A. Multiply the tenacity of the material in lbs. per square inch, and divide the product by the diameter of the sphere in inches.

(18) H. S. M. says: 1. The steam launch Arrow has wagon top boiler with large flat surfaces, which are stayed with ⅜ inch iron bolts 3 inches between centers; they are riveted into the shell in the usual manner. What is a safe load to use on stay bolts thus placed and fastened, and what pressure is safe on such a boiler? A. The data sent are rather incomplete, but we think the pressure should not exceed 60 lbs. 2. It has a screw 24 inches in diameter and 38 inches pitch. It makes 200 turns per minute. The hull is 28 feet long, with a beam of six feet She has a moderately "fine run." What is her probable speed? A. From 5 to 6 miles an hour.

(19) C. P. F. says: A. claims that by using foot valves, 1st 28 feet, 2d 14 feet, 3d 7 feet, 4th 3½ feet, 5th 1¾ feet from pump, that water can be pumped by suction atmospheric pressure 54¼ feet, while B. claims 33 feet is the theoretical, 32 feet the practical limit of pumping water by suction. A. We think B. has about the right idea.

(20) A. D. H. says: I am running an engine of an English make, the bore is 10 inches, stroke 27 inches. What is the horse power? A. You do not give sufficient data.

(21) J. S. B. & Co. ask: Is there any way that air could be purified after being once inhaled, or could oxygen be confined and admitted into a small cell at will, so as to sustain life? A. We think the difficulties to be overcome in realizing your plan, as we understand it, would be very great.

(22) P. J. K. asks for a formula to make rubber adhere to iron or steel? A. There are a number of good cements for this purpose in the market, and we think it will be more satisfactory for you to try some of them.

(23) S. G. F. says, for the best way to construct a penstock and the most suitable size for furnishing water to a 20 inch turbine wheel, the head being 36 feet. A. We think this may answer very well; but as we know nothing of the situation, we advise you to consult an engineer.

(24) To B. E. T. we say that every connection between motor and machine requires some power to drive it. The amount of loss in your case will depend upon the fitting up of the gears, and any guess we could make from the data sent would be of little value.

(25) H. E. E. says: We are using an engine 9 x 20 that has been running from one to three days in the week since 1861, with no repairs on the piston till last March, when the piston rings were so much worn that we had new ones put in. When first put in the saving of steam was one half, but lately we find the exhaust showing considerable leakage, so in taking out the piston I find the rings worn out again. A. We could not answer definitely without knowing more particulars. It was probable that the cylinder needs reboring. Allowing it to rust is very bad practice, and assists the wear of the rings. You should use sufficient oil to prevent this action, moving the piston slightly if the engine is not used for several days.

(26) H. E. H. asks: Will you inform me of a correct rule for finding the proper sizes of boilers for different sizes of steam engines? A. You will find some notes relating to the subject on p. 225, vol. 32.

(27) J. R. P. says: In a work entitled the "Electrical Theory of the Universe," I find the following: Immerse the prime conductor of a galvanic battery in a pint of water, and it will be converted into two thousand pints of its constituent gases, oxygen and hydrogen; now insert the same conductor into these gases, and it will be contracted back to one pint of water. Now if this change could be done quick enough, and not cost too much, would it not be a good motor for locomotives and other machines? A. Certainly, if.

(28) W. H. M. asks: 1. What is the longest span of suspension bridge in the world? A. We believe the largest suspension bridge that is completed has a clear span of 1,057 feet. 2. How much is the estimated cost of Brooklyn bridge? A. Between ten and twelve million dollars. 3. What is considered the greatest engineering work (as completed) at the present day? A. It would probably be impossible to name any single work which could be called the greatest in the opinion of everybody. 4. Is cold water pressure harder on a boiler than an equal steam pressure? If so, why? A. Cold water pressure is often more injurious than steam pressure, because with the former the boiler is not in the condition which occurs in actual practice, so that, when it is heated, it may be better able to resist the strain.

(29) I. T. W. says: I am making a steam engine cylinder $1\frac{1}{8}$ inch bore and 2½ inches stroke. What size boiler will it require? A. See pp. 33 and 225, vol. 33.

(30) W. F. says: Will you inform me of the mode of casting iron on to steel so as to form a solid weld? A. Perhaps some of our readers who have experience can aid the correspondent.

(31) J. N. asks: How many feet of pipe heating surface will an upright boiler of the following dimensions furnish economically with an average of 5 lbs. steam? Boiler 5 feet diameter, 151 2¾ flues 7 feet long, 3 feet 4 inches diameter of grate surface. Good draught. A. Such a boiler should evaporate 9 or 10 cubic feet of water an hour. The arrangement of flues mentioned is sometimes advantageous, but not always. You could only determine the question, in your case, by experiment. There is no standard for rating the power of boilers that is generally accepted by engineers.

(32) J. L. K. asks: 1. Is the Thomas steam wheel applicable to marine propulsion, and is it cheaper in construction than an ordinary engine? A. We do not discuss the merits of special manufactures in these columns. 2. What power can I expect from a windmill whose sails (4) are 5 feet x 2 feet in what is generally described as a stiff breeze? I cannot give you the pitch of sails, but presume that part is all right; it was made in London, England, and purchased from a ship wrecked on this coast. A. See p. 241, vol. 32.

(33) J. L. says: Will you give me the process for making rubber stamps? A. The rubber used for stamps may be either the pure gum (caoutchouc) or the sheet rubber, containing about 3 per cent of uncombined sulphur (not vulcanized rubber). In preparing the stamp the form is first set up in clean type well oiled, a retaining rim is set up about the face of the form, and a little thin cream of fine plaster of Paris worked in with a fine camel's hair brush. When all air bubbles have thus been excluded, the thicker plaster is run in to the depth of about three quarters of an inch, and the mould allowed a sufficient length of time in which to harden. The use of strong alum water in place of the clean water used in mixing the plaster will give a much harder mould, but the plaster then is longer in hardening. After thoroughly drying and baking, the mould is placed in a frame of suitable size, the sheet of rubber (about ⅛ inch thick) adjusted on its face, and the whole put in a small screw clamp and heated slowly until the rubber becomes sufficiently softened to admit of being easily forced into the mould by tightening the screw. The subsequent vulcanization of the rubber may be effected by immersing it for a short time in a mixture of 30 parts bisulphide of carbon and 1 chloride of sulphur, and then exposing in a room heated to 70° Fah. until all the sulphide of carbon has volatilized. Immersion in a boiling solution of 9 ounces of caustic potassa in a gallon of water for a few minutes, and subsequent washing in clean water completes the process, and the form is then ready for mounting. If the rubber is sufficiently softened, a very little pressure will cause it to copy the mould perfectly without breaking it. This also answers several other correspondents.

(34) H. C. asks for a recipe for making sealing wax. A. For red wax take shellac 4 ozs., melt and add 1¼ ozs. Venice turpentine. Mix and add 3 ozs. vermilion. It can be poured into moulds while melted, or rolled into sticks after it has cooled a little.

(35) N. A. B. says: 1. In the description of a magneto-electric engine on p. 8, vol. 33, I read: "By a suitable commutator, the currents circulating through the coils on the stationary magnet can be sent through those on the armature." Is reference had to the battery current, or the induced ones? A. The battery current. 2. Please tell me how to use the tangent galvanometer? A. The tangent galvanometer of most recent construction is composed of a compass dial five or six inches in diameter, having a fine steel point in the center. Underneath the dial are placed coils, of insulated copper wire of several capacities, designed to measure various currents, from those of great intensity with but little quantity, to those of great quantity with but little intensity. The magnetic needle which is supported on the fine steel point alluded to is composed of a number of thin, oblong steel plates, riveted upon a flat ring of aluminum and so trimmed as to form a perfectly circular disk. The average weight of the needle does not exceed 20 grains. The coils are placed so that the current runs parallel with the meridian of the needle. They are half an inch or more wider than the diameter of the disk. The intensity of currents, as measured by the tangent galvanometer, is proportional to the tangents of the angles of deflection—thus: let an electric current be sent through the galvanometer coil, whose directive force is precisely equal to that manifested by the terrestrial magnetism, and the needle, before at rest upon the meridian, will be deflected 45°; double the current passing through the coil and the needle will cut 63° 30′; with threefold the intensity of current the deflection will be 71° 34′; with fourfold, 76°, etc., according to the law of natural tangents. For measuring resistance, etc., of lines, a set of resistance coils is used in connection with the instrument. 3. As the Camacho electro-magnet develops so much power with a comparatively weak current, will it not produce proportionally powerful induced currents? A. Yes, under some circumstances. 4. I purpose making the positive pole for sesquioxide of iron battery in the form of a carbon cell, made as described on p. 129 SCIENCE RECORD for 1875, containing a quantity of the sesquioxide; or in the form of a cylinder composed of coarsely pulverized coke and sesquioxide made similarly to the coke-manganese pole

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described on p. 221, SCIENCE RECORD for 1876. Will both arrangements work, and which will be the better? A. The latter will have the least internal resistance, but will not be a very constant form. 5. Is there any alloy that expands when cooled, and contracts when heated? A. No; but a few of the metals or alloys, as those of antimony and bismuth, have the property of expanding considerably at the moment of solidification from fusion, owing to their tendency to crystalize.

(36) W. A., of Montreal, asks for the recipe for starch polish, or "concentrated starch," so-called? A. We do not know its exact composition, bnt think it is simply starch with a little grape sugar and paraffin.

(37) L. W. H. says: I want some method of preserving belts. I was told by an engineer to paint them with printer's black ink. Please let me know if this will damage belts that are in motion daily? A. A very little pure lard oil or neat's foot oil will preserve belts and prevent them from cracking. Castor oil is also used, but too much is worse than none. Daubing with printing ink is not recommended.

(38) R. B. G. says: I have a 12 x 24 inch engine, nearly new, runs 80 revolutions per minute, with which I wish to drive 2 pair 42 inch and 1 pair 30 inch burrs. My boiler is 42 inch x 26 feet, with two 16 inch flues. Is this boiler capacity sufficient? Give me the best plan to construct the furnace to give good draught and to economize fuel How much of the boiler shell should be exposed to the flames? What should be the size of an iron chimney, and how high? A. The boiler will be large enough in all probability. As to mode of setting, see p. 339, vol. 33.

(39) C. M. asks how to make a bichromate of potash battery? A. The carbon battery usually consists of a glass jar having within it a cup of porous, unglazed porcelain. The annular space between the sides of the vessels is filled with water slightly acidulated with oil of vitriol, and contains a sheet of zinc shaped so as to conform to the curve of the inner cup, which it nearly surrounds. A stick or prism of gas carbon is placed in the porous cup, and surrounded with a fluid made by adding strong sulphuric acid to a saturated solution of potassium dichromate until the red chromic acid just begins to separate in flakes, and then just enough water to redissolve the precipitate. The proportions of the several ingredients in this mixture should be about as follows: To 10 ozs. of potassium dichromate in a gallon of water, add 1 pint of strong oil of vitriol.

Please give me a recipe for polishing shells? A. See answer to H. C., p. 43, vol. 37.

(40) W. M. asks how to magnetize iron? A. Soft iron will not retain magnetism so as to become permanently magnetic. When a box of iron is surrounded by a coil of insulated wire (wrapped tight about it) through which a battery current is passing, the iron becomes a strong magnet. As soon, however, as the electric current is interrupted, the iron loses its magnetism and resumes its passive condition. You should consult some elementary treatise on electricity and magnetism or natural philosophy (physics). The best of these works may be consulted at the Astor Library.

(41) W. M. U., of Cork, Ireland, asks: 1. How is brown bronze on gas chandeliers and fittings done? A. Vinegar half a pint, copper sulphate 3 ozs.; hydrochloric acid 3 ozs., ammonium chloride 2 ozs., alum ½ oz. Dissolve the salts, reduced to a fine powder, in the vinegar and acids with the aid of heat, and apply to the brass warm. 2. Make a paste of 2 ozs. each of verdigris and vermilion, 5 ozs. each of alum and sal ammoniac (all in fine powder), and vinegar. Heat the paste, and spread it on the cleaned work previously warmed. The addition of a little sulphate of copper inclines the color to chestnut brown, and borax to yellowish brown. 3. Use the following bronze powder with an oil size: Copper filings 100 parts, carbonate of soda 60 parts; fuse, cool, powder, add 15 parts of copper filings, mix, heat to whiteness for 20 minutes, cool, powder, wash and dry. 2. How is black bronze done? A. Dip the work bright in nitric acid, quickly rinse with plenty of water, and place in the following mixture until it turns black: Hydrochloric acid 12 lbs., sulphate of iron 1 lb., pure white arsenic (arsenious acid) 1 lb. It is then taken out, rinsed with clean water, and dried in sawdust, and polished with black lead, and lacquered with a green lacquer made as follows: 1 gallon of wood naphtha (methylic spirit), 5 ozs. shellac, 4 ozs. gum sandarac, 1 oz. gum elimi; place in a tin flask and expose to a gentle heat for a day or two. Then strain off, add a half gallon of spirit, and treat as before. Finally dissolve in the liquor 6 ozs. of turmeric and 1 of gum gamboge. 3. Can brass before pouring be colored by placing anything on it so as to give it when turned in the lathe a rich color like straw? A. If we understand you, no. Yellow brass contains a larger proportion of zinc.

(42) I. H. P. asks: What will remove the stain of sugar of lead from lime? A. Try a little soda water (carbonic acid water). If this does not answer use oil of vitriol diluted with about 50 parts of water.

Should imitation black walnut paper wainscot be sized before being varnished? If so, what is the preparation for sizing, and what is the best varnish? A. Yes; use a thin glue water, and when perfectly dried varnish with copal.

What can be done to cleanse for domestic use iron vessels in which sulphur has been melted? The sulphur seems to have combined with the iron by incrustation. A. Boil in the vessels for some time strong aqueous solutions of caustic soda or potassa; then wash with plenty of clean water and scour with sand.

(43) S. S. T. asks how to make the lightest gas possible from coal, such as would be most suitable to inflate a balloon? A. Use a hard coal and work the charge at a high temperature and longer than usual. The gas should be well washed and purified. Peat gives a lighter gas than coal.

(44) M. M. says, in answer to C. R., if he will so arrange his flue that the smoke from his boiler will pass vertically downward into a small chamber of 3 or 4 times the sectional area of his smoke flue, and from that chamber pass into the smoke flue, very few sparks will ever rise. If he will keep the floor of this receiving chamber flooded with water, neither sparks nor dirt can possibly pass up the smokestack. I have seen this tested and know it to be a perfect cure.

(45) B. R. T. asks how to make printer's rollers, and moulds for the same. A. The roller mould may be a brass, zinc, or tin tube of the size required. Oil it on the inside before pouring the composition into it. This is to prevent sticking. For the roller composition to use in summer take good glue, prepare as for gluing wood work, and add about twice the quantity of good molasses, and boil together for a short time, say an hour or two, then pour in the mould. If too soft when it gets cold, remelt and add more glue.

(46) J. E. asks for a recipe to make black ink, and is referred to reply to T. C. (54) p. 76, No. 5, present volume.

(47) J. A. H. is informed that we know nothing of the opportunities for his business in Japan. We doubt if employment could be secured there that would pay better than here.

(48) W. J. asks: Have any detailed drawings of the Brayton gas engine been published? A. In No. 20, vol. 34, and No. 2, vol. 36 of the SCIENTIFIC AMERICAN, and in Nos. 24 and 58 of the SCIENTIFIC AMERICAN SUPPLEMENT, you will find cuts and descriptions that will give you the information.

(49) H. K. asks: What is the best solution for tempering coalpicks? What is used for tempering dies and knives, and how is it done? Which is the best method to straighten a horse's hoof? A. Vol. 31 of the SCIENTIFIC AMERICAN contains about a dozen good articles on hardening and tempering to which reference is made. No two experts in hardening and tempering use precisely the same solutions or manipulate the tools to be tempered in the same manner. Each one would probably claim their process as the best. Conditions are such, as regards quality of steel, hardening, etc., that it is impossible to give the best solutions or the best methods. In reply to the last question our correspondent had better consult a farrier.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

S. M. S.—The scale consists principally of carbonate and sulphate of lime, some carbonate of iron, and a little alumina and silica. There is nothing in it of a poisonous nature. The mineral matter forming the scale is most readily precipitated from the water by boiling. Allow the water to settle and siphon off from the sediment.—W. P. C.—It is flint.—M. C.—It is an earth or soil containing a large quantity of carbonaceous matter apparently of animal origin. Earth of a similar nature is often found in the caves of guano districts. The percentage of ammoniacal salts is very small, but it contains enough of the phosphates to be of some value as a fertilizer.—T. W.—It is not plumbago, but a shale of little value. It may pay you to look deeper.—B. F. G.—Nos. 1 and 4 are not trap rock, but a limestone containing garnets and idocrase—a compound of lime, iron, alumina, and silica. Nos. 2 and 3 contain copper.—H. W. K.—We cannot find your box of minerals.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Darwin and Others on Creation. By Dr. H. D. T.

On Determining the Proportions of Gear Teeth. By O. E. M.

On Hydraulic Cements, Stone, etc. By ——.

On Geometrical Problem and Instrument. By W. G. B.

Also inquiries and answers from the following:

D. L. H.—H. W. K.—J. S. A. B.—G. R. C.—W. C. L.—J. M.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

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OFFICIAL.

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FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 3, 1877,

AND EACH BEARING THAT DATE.

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10,082.—CASSIMERES.—F. S. Bosworth, Providence, R.I.

10,083.—EMBROIDERY PATTERN.—E. Crisand, New Haven, Conn.

10,084.—HEATING STOVES.—J. A. Lawson, Troy, N. Y.

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10,086.—MATCH SAFES.—W. H. Matthai, Baltimore, Md.

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10,088.—MONUMENT.—A. M. Buchanan, Moberly, Mo.

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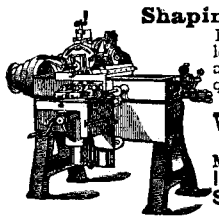

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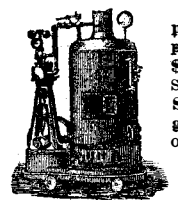

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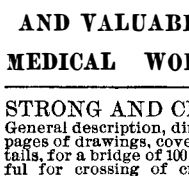

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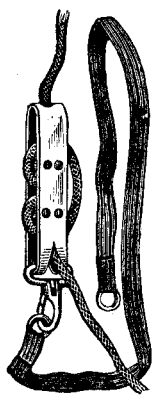

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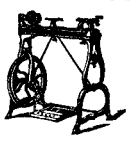

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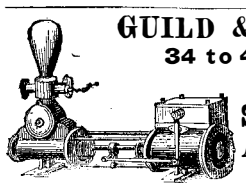

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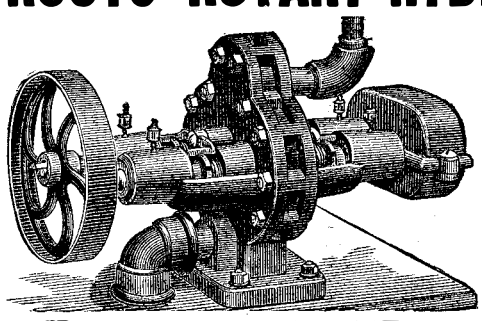

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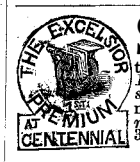

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